THE INDIAN ASSOCIATION
FOR THE
CULTIVATION OF SCIENCE

Annual Report for 1956-57

THE INDIAN ASSOCIATION
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ANNUAL REPORT FOR 1956–57

JADAVPUR, CALCUTTA—32

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Nominee of the Government of West Bengal.		Dr. D. M. Sen, M.A., Ph.D.
Professor-Member	...	Prof. D. Basu, Ph.D.

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1. GENERAL

During the year under review, the Council condoled the death of Dr. H. C. Mookerjee, Governor of West Bengal and a distinguished educationist and philanthropist. Death was also reported of Sri J. M. Sen, a distinguished educationist and a sitting member of the Council, which was condoled by the Council. In Sri Sen the Association lost one of its most active members and well-wishers.

The year under review was the first of the second Five-Year Plan period, the outline of which was presented in the report of the previous year. An all-out effort was made to direct the affairs of the Association in accordance with the Plan. The Government of India were pleased to fix a ceiling of Rs. 40 lakhs for recurring and Rs. 25 lakhs for non-recurring expenditure during the second Plan period and the Government of West Bengal a sum not exceeding Rs. 16 lakhs for the same period. The ceiling thus fixed by the Government of India and the State Government was somewhat less than the grants requested on the basis of the Plan and necessitated a revision of the annual break-down of expenditures.

Construction Works

The construction of the first floor of the workshop designed to accommodate the Rubber Section of the Technological applications of High Polymers Programme and the Section on Training in High Polymers, which was reported last year, was completed during the year under review with the exception of electrical, sanitary, gas and water pipe installations. The work of construction of the first floor of the main research building was undertaken during the year and the tender let out to Messrs. Martin Burn Ltd., for Rs. 3,48,606/-. This firm, it might be recalled, also constructed the ground floor, the Assembly Hall, the Library and other structures of the Association. Despite difficulties in getting quota certificates for steel sections and cement permits, substantial progress was made by the end of the year. Other works included the sinking of an additional tube-well and the construction of a small garage. Steps were also taken to fill up the low lands of the Association.

Council Election, Enrolment, Deaths and Resignation of Members, Election of Fellows

The annual election of Ordinary Members of the Council was held as usual during the months of April and May, 1956 and the result announced at the Annual General Meeting of the Association held on August 18, 1956. Dr. J. C. Ghosh and Hon'ble Chief Justice Sri P. B. Chakravartti were elected to the office of two Vice Presidents in place of Prof. S. K. Mitra and Dr. K. S. Krishnan. Prof. S. K. Mitra and Dr. Atmaram were elected Ordinary Members of the Council. The National Institute of Sciences of India nominated Dr. K. S. Krishnan and Prof. P. S. Gill and the Government of India Sri K. Sachidanandam on the Council of the Association for 1956-57. Dr. D. Basu was appointed Professor-Member of the Council. In the vacancies caused by the election of Dr. J. C. Ghosh and Hon'ble Sri P. B. Chakravartti as Vice Presidents and by the death of Sri J. M. Sen, the Council appointed Dr. K. Biswas, Sri N. N. Sen and Dr. T. Sen as Ordinary Members of the Council.

The Council offered their warm felicitations to Sri P. B. Chakravartti and Sri R. P. Mookerjee on their respective appointments as interim Governor of West Bengal and as Chief Justice, Calcutta High Court.

During the year under review, two gentlemen were elected Life Members, ten gentlemen enrolled as Ordinary Members and seven gentlemen admitted as Ordinary Members of the Association. During the same period one gentleman resigned his membership, and the membership of eleven Ordinary Members ceased for non-payment of subscription for over two years.

Dr. K. Biswas was elected an Ordinary Fellow of the Association.

Meetings of Council and Committees

Besides the Annual General Meeting, 6 meetings of the Council, 5 of the Finance Committee, 14 of the Staff Committee and 37 meetings of the various Selection Committees and Appointing Boards were held during the year. In the same period 3 meetings of the Construction Committee, 2 meetings of the Fellows and one meeting each of the Board of Editors and Leave Rule Revision Committee were held. The Leave Rule Revision Committee, jointly with the Finance Committee, recommended a set of revised by-laws for travelling allowance, vacation and holidays and leave rules, more or less on the basis of the Government of India rules, which were adopted by the Council with minor alterations.

Meghnad Saha Memorial

A Memorial Committee was appointed to make recommendations on the question of perpetuating, in a suitable manner, the memory of late Prof. Meghnad Saha. The Committee was of opinion that the most fitting way

of perpetuating his memory would be the institution after his name of a Professorship relating to the development of resources. The institution of such a Professorship, it was estimated, would require about a sum of Rs. 5 lakhs to be invested for this purpose. The Council advised circulation of this proposal to its members inviting their suggestions, and postponed consideration of the matter till the views of all members were available. Other recommendations of the Committee were (*a*) the award of a gold medal to a distinguished scientist for delivering a memorial lecture every year, the cost of the medal to be met from the recurring budget; (*b*) the publication of the collected works of Prof. Saha; and (*c*) observing his birth anniversary. These recommendations were approved by the Council and an editorial board was appointed for the publication of Prof. Saha's collected works.

Prof. Ray indicated his desire to accept, during his officiating Directorship of the Association, only a sum of Rs. 750/- as honorarium and suggested that the saving made from the Director's salary therefrom be donated to the Meghnad Saha Memorial Fund of the Association.

Research Departments, Visit to Foreign Countries by Members of Staff and Scholars and Participation in Symposia, Conferences, etc.

Prof. P. Ray continued to act as officiating Director and also remain in charge of the Department of Inorganic Chemistry as Professor of Inorganic Chemistry pending the appointment of Director which was under the consideration of the Selection Committee.

During the year under review, a new research Department of Magnetism was established and Dr. A. Bose was appointed Professor of Magnetism. A new Section of Training in High Polymers under the Department of Organic Chemistry was opened with the appointment of Sri P. Bagchi as a Reader and of other staff. The Department of Physical Chemistry was strengthened by the appointment of Dr. J. N. Sen as a Reader. The Rubber Section of the same Department was opened with the appointment of a Research Officer, Laboratory Assistant (Tester) and other staff. The research departments of General Physics and X-rays, Optics, Theoretical Physics and Inorganic Chemistry were strengthened by the appointment of new staff and scholars. In the Administration, the Workshop, and the Library, appointments were made to the newly created posts of Accounts Officer, Assistant Accountant, Workshop Superintendent, Assistant Librarian and clerks. The new posts to which appointments could be made represented roughly 60 per cent of such posts originally provided for in the budget estimates for 1956-57. Reduction of staff by about 40 per cent was found unavoidable in view of the ceiling of the Government of India and the State Government grants being fixed at a level lower than the original demands submitted to the Government.

During the year under review, Prof. A. Bose attended an international conference on magnetism in Moscow and worked at the Clarendon Laboratory, Oxford, as a Royal Society bursar.

Prof. S. R. Palit was invited to be included in a delegation of Indian scientists to visit the U.S.S.R. for three weeks.

During the year, Prof. S. R. Palit, Sri P. Bagchi, Dr. J. N. Sen, Dr. U. S. Nandi and Sri Nitish K. Sanyal of this Association participated in a symposium on High Polymers organized under the joint auspices of the Plastics Research Committee of the CSIR and the National Chemical Laboratory at Poona. Prof. P. C. Dutta attended the Annual General Meeting of the Essential Oil Association of India in Kanauj.

A number of scholars of the Association, Sri Sunil Kumar Dutta, Sri Dhruba Ranjan Das Gupta, Sri Suryya Kumar Das, Sri Sujit Kumar Ghosh, Sri Udai Narayan Singh, Sri Ramji Rao, Dr. Asoke Kumar Mitra, Dr. Purnendu Kumar Talukdar left for higher studies and research in European and American universities and research institutions.

Dr. Jiban Kumar Chakrabarti and Sri Kalyanmoy Sen have been offered a Fellowship and an Assistantship respectively in U.S. Universities.

Research Schemes

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

Under Prof. S. R. Palit as investigator-in-charge:

(1) Construction of light scattering apparatus for the measurement of molecular weight, size and shape of high polymers;

(2) Studies on thermodynamic properties of high polymer solutions;

(3) Mutual solubilization of oil and water.

All the three schemes were continued from the previous year; the last named scheme was terminated during the year.

Under Prof. B. N. Srivastava as investigator-in-charge:

(1) Thermal diffusion and interdiffusion of gases, continued from the previous year.

Under Prof. S. C. Sirkar as investigator-in-charge:

(1) Investigation of crystal structure of frozen organic liquids at low temperatures, continued from the previous year.

The following new schemes were sanctioned during the year:—

Under Prof. P. C. Dutta: (1) Synthetic studies in diterpenoid resin acids.

Under Dr. J. N. Sen: (1) Absolute rate constants in polymerization.

Development scheme for research training facilities under the Scientific Man Power Committee: This scheme initiated by the Ministry of Natural Resources and Scientific Research was in the sixth year of its operation during 1956-57. Under the scheme 15 senior and 6 junior scholars were made available, but 4 junior scholarships (5 towards the end of the year) remained idle in the absence of the Government of India decision to convert these scholarships into senior ones as stated in the previous report.

National Research Fellowship: Sri U. S. Nandi of the Department of Physical Chemistry continued as the National Research Fellow of the Government of India, Ministry of Education. Sri G. R. Somayajulu of the Dept. of Physical Chemistry was also selected for this Fellowship on the condition that the award would be made effective on his receiving the doctorate degree for which he had already submitted his thesis.

Other Schemes: During the year sanction was received for a scheme on "Synthetic polyelectrolytes as soil conditioners" of the Indian Council of Agricultural Research, and another scheme on "Styrenation of shellac" of the Indian Lac Cess Committee, both under Prof. S. R. Palit.

The Atomic Energy Commission sanctioned a scheme on "Design of thermal diffusion column for efficient isotopic separation" under Prof. B. N. Srivastava.

The Director of Public Instruction, Government of Assam sanctioned a scholarship of Rs. 100/- for work under Prof. P. C. Dutta for one year.

Doctorate degrees awarded to research workers

The following research workers of the Association were awarded the degree of Doctor of Philosophy (Science) of the Calcutta University during the year under review:—

Sri Sushil Kumar Chowdhury, a part-time honorary research worker in the laboratories of the Department of Optics, for his work on "Investigation on structure of jute fibre and its derivatives with the help of X-rays".

Sri U. S. Nandy, a National Research Fellow of the Department of Physical Chemistry for his work on "Studies on Reaction Kinetics of Vinyl Polymerization".

Sri Pranbandhu Dutta, a Research Assistant of the Department of Organic Chemistry, for his work on "Synthetic Studies on the reduced naphthalene and phenanthrene derivatives".

Sri Bejoy Kumar Ganguli, of the Department of Organic Chemistry for his work on "Synthetic experiments in Friedel-Crafts Reaction".

Sri Anath Jiban Bhattacharyya, of the Department of Organic Chemistry, for his work on "Synthesis of polynuclear compounds with a fused cyclopentane ring".

Ripon Professorships, Joykissen Mookerjee Medals and Mahendralal Sircar Memorial and other lectures

During the year under review, Professor N. R. Sen of the University College of Science, Calcutta, who was appointed Ripon Professor of the Association for 1951 (vide Annual Report for 1953-54) delivered a course of three lectures on "The Modern Theory of Turbulence" in the month of April, 1956. Dr. Hari K. Sen, Physicist, Geophysical Research Directorate, Air Force, Cambrige Research Centre of U.S.A. was appointed the Ripon Professor of the Association for 1956, and delivered a course of two lectures on "High temperature Physics and Shock Phenomena" in December, 1956.

Joykissen Mookerjee Gold Medals for 1953 and 1954 were awarded respectively to Sir Harold Spencer Jones, F.R.S., former Astronomer Royal, and to Dr. G. Herzberg, F.R.S., of the National Research Council, Canada. Sir Harold delivered a lecture on "Expanding Universe" on January 21, 1957. Dr. Herzberg delivered two lectures on "Spectroscopy and Molecular Structure" on January 11 and 12, 1957.

Prof. A. C. Banerjee, Ex-Vice-Chancellor of Allahabad University, delivered the Memorial Lecture on "Inter-Planetary Flight" on the occasion of the 53rd. Death Anniversary of late Dr. Mahendra Lal Sircar, the Founder of the Association, on February 23, 1957.

Academician N. N. Bogolynbov, Professor and Member of the Academy of Sciences delivered a lecture on "Dispersion Analysis and Causality Principles" on December 21, 1956.

Madame Lecomte du Novy delivered a lecture on the life and work of her husband late Lecomte du Novy, a biologist of international fame.

General Publications

During the year under review, the special monographs brought out include "Himalayan Earthquakes" by Dr. S. K. Banerji, being the text of his Ripon Professorship Lectures, and "Magnetism" being the report of a symposium on Magnetism held under the joint auspices of the National Institute of Sciences of India and the Association in 1954.

Library

The Library stock increased by 300 books during the year under review. 96 journals were subscribed and 120 journals were received in exchange. A further addition was made of 65 periodicals and bulletins as complimentary copies. A list of these books and periodicals is given in the Appendix. Of journals, back volumes of which have been purchased by the Library, special mention may be made of Isis, Helvetica Chimica and Chemical Reviews.

Indian Journal of Physics and Proceedings of the Indian Association for the Cultivation of Science

During the period from April 1, 1956 to March 31, 1957, 13 issues of the Indian Journal of Physics were published, of which ten issues belonged to vol. 30 (1956) and three issues to vol. 31 (1957). The arrear in publication was thus covered and the journal is being published regularly.

The year of the journal continued to be the calendar year. During the period mentioned above 96 papers and 21 'Letters to the Editor' were received for publication against 92 papers and 4 'Letters' in the preceding year. Of these 96 papers and 21 'Letters', 67 papers and 11 'Letters' were accepted for publication, 22 papers and 6 'Letters' were rejected by the referees and 7 papers and 4 'Letters' were under consideration. Besides these, there were 15 more papers brought forward from 1955-56. Of these 82 papers and 11 'Letters', 50 papers and 7 'Letters' were published in the last 9 issues of vol. 30 (1956) and 17 papers and 4 'Letters' were published in the first three issues of vol. 31 (1957). Nothing was published in the portion "Proceedings of the Indian Association for the Cultivation of Science". Vol. 30 comprised of 65 papers and 9 'Letters' covering 627 pages, besides 22 Plates and the 'Index' covering 17 pages. In the previous volume (1955) there were 64 papers and five 'Letters to the Editor' covering 604 pages, besides 16 Plates and the Index covering 16 pages.

The number of subscribers in 1956 was 250 through the Indian Physical Society, 81 others in India and 292 in foreign countries. The corresponding figures for 1955 were 250, 88 and 271 respectively. 84 copies of the journal were sent to members of the Association and 123 copies in exchange of other scientific journals.

The Board of Editors for 1956 consisted of the following members:

Prof. R. K. Asundi, Prof. K. Banerjee, Prof. D. M. Bose, Prof. K. R. Dixit, Prof. P. S. Gill, Prof. S. N. Bose, Prof. S. K. Mitra, Prof. P. Ray, Prof. K. R. Rao, Prof. M. N. Saha (since deceased), Prof. S. C. Sirkar (Secretary) and Prof. B. N. Srivastava.

Visitors

During the year under review, several distinguished persons as well as foreign scientists and delegates of a number of foreign missions visited the laboratories of the Association. Among them were: Dr. John F. Hogerton, F. C. Von du Lage, Dr. John H. Nelson and others, of an American team of atomic experts touring India, Dr. L. A. DuBridge of California Institute of Technology, U.S.A. and Dr. D. E. Goldman of the Office of Naval Research, U.S.A., Dr. M. Watanabe, Tokyo, Japan; Academician N. N. Bogolynbov of U.S.S.R.; Dr. G. Herzberg of the National Research Council, Canada; Sir Harold Spencer Jones, U. K.; and Dr. S. T. Pan of the Institute of Applied Physics, China; Academician A. N. Nesmeyanov, President of U.S.S.R. Academy of Sciences, and Prof. Engelhardt, Professor of Biology, U.S.S.R.

Grants-in-aid and Donation

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

	Rs.	AS.	P.
(A) *Government of India*			
(1) Recurring	5,97,870	0	0
(2) Contribution towards Dearness Allowance ...	30,130	0	0
(3) Non-recurring	3,60,000	0	0
(4) Grant for Development Scheme for research training facilities of the Scientific Man-Power Committee	18,216	3	0
(5) National Research Fellowship	6,832	4	0
(B) *Government of West Bengal*			
(1) Recurring (sanctioned but payment received during 1957-58)	56,000	0	0
(2) Non-recurring	1,36,000	0	0
—do— (sanctioned but payment received during 1957-58)	1,36,000	0	0
(C) *Council of Scientific and Industrial Research Schemes*			
(1) Construction of Light Scattering Apparatus for the measurement of molecular weight, size and shape of High Polymer	6,389	4	0
(2) Studies on thermodynamic properties of High Polymer solution	9,478	10	0
(3) Thermal diffusion and inter-diffusion of gas ...	5,070	1	9
(4) Mutual solubilization of oil and water ...	4,101	11	0
(5) Crystal structure of frozen organic liquids at low temperature	4,050	13	6
(6) Absolute values of rate constants in polymerisation	11,900	0	0
(7) Synthetic studies of deterpenoid acids etc. ...	1,520	0	0
(D) Contribution received from the Indian Physical Society for publication of the Indian Journal of Physics	1,650	0	0
(E) Grant from Indian Lac Cess Committee ...	3,400	0	0

The East India Pharmaceutical Works Ltd. have made a gift of chemicals worth Rs. 2,000/- only to the Department of Organic Chemistry as in previous years.

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 the Government of India, and the Professor-Member, for their services to the cause of the Association.

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

II. RESEARCH WORK CARRIED OUT IN THE DEPARTMENTS DURING THE FINANCIAL YEAR 1956-57

A. DEPARTMENT OF GENERAL PHYSICS AND X-RAYS

Work on the following lines was in progress in the different sections of the department during the year under review:

I. *General Physics*:

(1) Thermal diffusion in gas mixtures;

(2) Inter-diffusion of gases;

(3) Thermal conductivity of gas mixtures;

(4) Low temperature physics;

II. *X-rays*:

(5) X-ray crystallography and allied problems;

(6) X-ray study of amorphous and fibrous materials;

(7) X-ray study of alloys;

(8) Low temperature X-ray work.

Thermal diffusion in gas mixtures

Investigations on transport properties of gases started two years ago have been considerably expanded and very valuable results have been obtained which have been published in the form of several papers in scientific journals throughout the world. The research scheme of the Council of Scientific and Industrial Research on 'Thermal diffusion and inter-diffusion of gases' has been continued during the year.

Potential parameters for unlike molecular interactions on Exp-six model have been evaluated by B. N. Srivastava and K. P. Srivastava from variation of thermal diffusion factor with temperature following the method developed by B. N. Srivastava in a series of papers. Two methods, one graphical and the other computational, have been developed and are found to give excellent results which have been published in the form of two papers.

A set of semi-empirical combination rules has been developed by B. N. Srivastava and K. P. Srivastava which gives the exp-six potential parameters for unlike interactions from a knowledge of like interactions. K. P. Srivastava has tested these rules extensively by calculating the transport properties of several binary gaseous mixtures and found satisfactory agreement with the experimentally observed values.

Thermal diffusion factor for isotopic mixtures has been calculated by S. C. Saxena on the two schemes of approximations: (1) Chapman and Cowling's second approximation formula and (2) Kihara's first approximation formula. It has been shown that the latter gives better results than the former and is at the same time much simpler.

Considerable progress has been made in the construction of the thermal diffusion column. The required precision tubings have been obtained and are being suitably mounted on specially designed supports. Arrangements for viewing and centering the column from the top have been completed. Towards the close of the year a scheme entitled "Design of Thermal Diffusion Column for efficient Isotopic Separation" has been sanctioned by the Atomic Energy Department of the Government of India.

Inter-diffusion of gases

K. P. Srivastava completed the construction of the low temperature bath with certain modifications. A new type of stirrer was designed and constructed for efficient stirring at very low temperatures. A good temperature control of 0·01° C. has been achieved with a sensitive toluene regulator in conjunction with an efficient electronic relay. The two-bulb diffusion apparatus has been tested to stand high vacuum and to give desired leaks through a capillary tube for analysis. The differential conductivity analyzer which was constructed earlier has been tested for vacuum and compression and is found to be quite satisfactory in operation. The electrical bridge circuit for recording a change in the resistance of the conductivity analyzer by a few millionths of ohm has been completed and tested for satisfactory working.

S. C. Saxena has developed generalized relations for the three elementary transport coefficients and utilized them to predict the transport properties of radon. He has also calculated the various transport properties of binary mixtures of rare gases from the experimental potential parameters on the 12:6 model and found satisfactory agreement with observed values.

Thermal Conductivity of gas mixtures

The experiments on the thermal conductivity of gas mixtures were continued. S. C. Saxena measured the thermal conductivity of He, A and Xe gases, singly and in binary and ternary combinations for various concentrations and found the results to be in good agreement with the theory. The formula developed by B. N. Srivastava and S. C. Saxena for calculating the thermal conductivity of a ternary mixture from the data on binary conductivities was found to yield results in excellent agreement with the experimentally observed values.

Based on the thermal conductivity apparatus set up in our laboratory, an easy but accurate method for analyzing binary gaseous mixtures has been suggested.

The variation of observed thermal conductivity with temperature has been utilized by K. P. Srivastava for determining like molecular interactions on exp-six model. These potential parameters are found to predict all the transport properties very satisfactorily.

Low temperature physics

The helium liquefier has now been completely installed. The auxiliary helium purification circuit has been designed, fabricated and installed and the various automatic controls are being fabricated. Preliminary running of the liquefier showed that with the purity of the commercial hydrogen gas available at Calcutta it was necessary for efficient running to insert a precooler in the hydrogen circuit for further purification. Such a precooler has been designed with suitable liquid air feed arrangements, and is being installed.

A detailed survey of the existing theories and the experimental work done so far on electrical and thermal conductivities of metals and alloys has been carried out, and design of experiments is in progress.

X-ray crystallography and allied problems

The crystal structure of $BaBOF_3$ was completed by D. M. Chackraburtty with refinements. The crystal system was determined to be orthorhombic with the space group Pmna, and the atomic co-ordinates were derived on several considerations. After the analysis, it was found out that each boron atom is surrounded by three fluorine atoms and one oxygen atom forming nearly regular tetrahedron. The distance from boron to fluorine atoms varies between 1·43Å to 1·434Å and from boron to oxygen atom it is 1·435Å. The nearest barium to oxygen and fluorine distances vary between 2·84 Å to 2·86 Å.

The structure of another substance $NH_4AsO_2F_2$ which was determined to be tetragonal by the application of the method of Hesse with the likely space group as C^5_{4n} has been nearly completed by D. M. Chackraburtty. Preliminary analysis confirms the distances between As and O & F atoms as 1·62 Å to 1·65 Å. Final calculations and refinements are still in progress. The substance was studied at high temperature and crystallographic changes have been detected and worked out.

D. M. Chackraburtty has also undertaken systematic work on oxy-fluoride compounds of nickel and zinc. Analysis up to space groups of each of these compounds has been completed and hopeful solutions for the working out of the structures have been found.

X-ray study of amorphous and fibrous materials

D. M. Chackraburtty continued the work on the cellulose fibres for the measurement and interpretation of micellar and intermicellar spaces of different

fibres. Infiltration method of colloidal particles in fibre-framework was extended in Nettle fibres and the dimensions of the intermicellar spaces were found out to be 89Å-91Å. The work for micellar dimension by small angle scattering is continued with suitable adaptations.

Systematic X-ray diffraction studies were completed on different leathers by D. M. Chackraburtty and B. Chakravarty. It was noticed both from photometric curves and direct measurements that the spacing for the diffuse intense band was varying from sample to sample. A probable explanation of these variations has been given by assuming distortions in the Pauling's model of polypeptide chains in the collagen-gelatin protein groups.

N. N. Gupta extended the "radial distribution" analysis of 18 carbon samples. Instead of 16 or 32 coefficients he has taken 64 coefficients in each analysis and the final results showed enormous improvements in the predictions. The first peak in the radial distribution curves of all these carbon samples has appeared at 1·47 Å. In addition to this there are common and uncommon peaks in the analysis of all the samples. The final common result shows that Cardon—Carbon bond length in all the substances studied is 1·47 Å corresponding to the bond order of 1·48 Å which is different from that of diamond and graphite.

X-ray study of alloys

Systematic studies of the equilibrium diagrams of binary alloys of Zn, Th, Cd and Al is being undertaken by Abdul Quader both by X-ray as well as thermal methods with a view to elucidate the structural features and phase changes occurring at the transition points. E. M. Gopalkrishna is starting work on the order and disorder phenomena in Cu and Ni alloys.

Low temperature X-ray work

Satisfactory progress in the construction of Low Temperature Camera has been made. The stainless steel Dewar assembly was completed and the construction of the other parts is in progress.

List of Papers Published During the Year 1956-57

1. 'Generalised Relations for the thermal diffusion factor of inert gas mixtures with one invariable constituent'—by B. N. Srivastava and S. C. Saxena, *Physica,* **22,** 253, 1956.

2. 'Evaluation of Collision Integrals occurring in higher approximations to diffusion coefficients'—by S. C. Saxena, *J. Chem. Phys.,* **24,** 1209, 1956.

3. 'On the two schemes of approximating the transport coefficients (Chapman-Cowling and Kihara)'—by S. C. Saxena, *J. Phys. Soc.,* Japan, **11,** 367, 1956.

4. 'Generalised relations for the three elementary transport coefficients'—by S. C. Saxena, *Physica,* **22,** 1242, 1956.

5. 'Thermal conductivity of helium-argon-xenon ternary mixtures'—by S. C. Saxena, *J. Chem. Phys.*, **25**, 360, 1956.
6. 'Combination Rules for potential parameters of Unlike Molecules on Exp-Six model'—by B. N. Srivastava and K. P. Srivastava, *J. Chem. Physics*, **24**, 1275, 1956.
7. 'Thermal Conduction and Gas Analysis'—by S. C. Saxena, *Nature*, London, **178**, 1462, 1956.
8. 'Force constants for Unlike Molecules on Exp-six model from thermal diffusion'—by B. N. Srivastava and K. P. Srivastava, *Physica*, **23**, 103, 1957.
9. 'Transport coefficients and force between Unlike Molecules'—by S. C. Saxena, *Ind. Jour. Phys.*, **31**, 146, 1957.
10. 'An X-ray Analysis of Bivalent Silver Nicotinate'—by D. M. Chackraburtty, *Acta Crystallographica*, **10**, 128, 1957.
11. 'An application of Lipson's method in determining the crystal system of $BaBOF_3$'—by D. M. Chackraburtty, *Ind. Jour. Phys.*, **31**, 235, 1957.
12. 'Transition Temperatures of some Polymers by Differential Thermal Analysis'—by D. M. Chackraburtty, *Jour. Chem. Phys.*, **26**, 427, 1957.
13. 'The structure of $BaBOF_3$'—by D. M. Chackraburtty, *Acta Crystallographica*, **10**, 199, 1957.

Papers in the Press

1. 'Thermal conductivity of Binary and Ternary rare gas mixtures'—by B. N. Srivastava and S. C. Saxena, *Proc. Phys. Soc.*, London, 1957.
2. 'Thermal conductivity of binary and ternary mixtures of helium, argon and xenon'—by S. C. Saxena, *Ind. Jour. Phys.*
3. 'Formulas for the thermal conductivity of ternary gas mixtures'—by B. N. Srivastava and S. C. Saxena, *Jour. Chem. Phys.*
4. 'Inter-molecular Potentials for Unlike Interaction on Exp-six model'—by K. P. Srivastava, *J. Chem. Phys.*, 1957.
5. 'Force constants for Unlike molecules on exp-six model from Thermal Conductivity'—by K. P. Srivastava, *Ind. Jour. Phys.*
6. 'X-ray measurements on Nettle Fibres'—by D. M. Chackraburtty, *Nature*, 1957.
7. 'An X-ray study of Leathers'—by D. M. Chackraburtty and B. Chakravarty, *Ind. Jour. Phys.*

B. DEPARTMENT OF MAGNETISM

The magnetism section of the Association has been constituted into a full-fledged department in course of the current year and in consequence much time has been spent in organizational works regarding accommodation, stores, etc. Yet in spite of all these difficulties, the existing programme of investigations were continued as well as new lines of work planned and undertaken. A brief account of these activities is given below.

Magnetic anisotropy and the paramagnetic behaviour of crystalline solids

The method developed in this laboratory by A. Bose and his collaborators for ascertaining the paramagnetic behaviour of an ion when embedded in a crystalline medium, which involves simply the measurement of the anisotropies of an isomorphous series of similarly constituted salts having the same paramagnetic ion and which has been successfully utilized in the cases of the hydrated

salts of Cu^{++} and Ni^{++}, has been extended by S. K. Dutta and others to the cases of Fe^{++} and Co^{++} salts. The results obtained have been found to be very encouraging and attempts are also being made to extend these studies to other series of such salts.

Magnetic behaviour of paramagnetic alums

S. K. Dutta Roy is continuing his accurate determinations of the absolute susceptibilities of a large number of paramagnetic alums over wide ranges of temperatures. He had been successful in the extremely difficult task of preparing the Ti^{+++} alums in the state of single crystals. In contrast to the Cr^{+++} and other alums it has been found that Ti^{+++} alums do not deviate from the Curie law. Attempts are being made to explain these anomalies.

Absolute susceptibilities of anisotropic single crystals

A. Chakravarty has developed a very sensitive, robust and simple microbalance for determining the absolute susceptibilities of single crystals whose anisotropies have already been measured. This balance works on accurately ground jewelled pivots and on torsional balancing system. He is utilizing this balance in finding out the absolute susceptibilities of a large number of Tutton salts of the iron group of elements at different temperatures, which evidently is an essential requirement in the complete magnetic analysis of such crystals.

Magnetic studies of different glass systems

Anisotropy which is developed in glass systems by unidirectional stretching in the molten condition and which has been detected here by magnetic observations has been subjected to further investigations by introducing different colouring agents into them. This will help in finding out the amount of alignment of the groups of atoms constituting the glass, responsible for the anisotropy and which was so long not very easy with the simple untinted glass systems.

Theoretical studies

A. Chakravarty is continuing his critical studies of the developments of the different theories for explaining the results of magnetic observations with a view to modifying or amending the existing theoretical approaches which have been found to be insufficient for dealing with the experimental results.

Study of paramagnetic resonance

It is now well recognized that the method of paramagnetic resonance is a very elegant and sensitive way of studying the magnetic behaviour of different substances and that such a method, combined with our magnetic methods, will

undoubtedly be the most powerful tool of studying crystal magnetism. It was, therefore, decided last year to start such investigations here and Dr. A. Bose of this department was deputed to the Clarendon laboratories, Oxford, to have first hand information regarding paramagnetic resonance experiments. In the meantime all microwave components necessary for such studies are being assembled here and preliminary observations taken.

Semi-conductors

For studying the electronic behaviour of semi-conductors, micro-wave techniques have of late been found to be very useful and convenient. The various microwave instruments and appliances which are necessary for paramagnetic resonance experiments and which have now been acquired by this laboratory are being utilized for the study of semi-conductors.

Cryogenics

The existing hydrogen liquefier cryostate, which has been constructed for taking the usual magnetic and electrical measurements at low temperatures has been further altered for making it suitable for paramagnetic resonance experiments.

Structural studies

Single crystals of graphite when subjected to chemical and thermal treatments have been found to give values of the electrical conductivities along the hexagonal axis different from those of the untreated crystals. This has been shown with the help of X-rays to be due to the changes in the interplanar distances in that direction, caused by such treatments.

D. R. Dasgupta and A. K. Roy are continuing the X-ray studies of the catalytic action of the impurities on the phase transformation by thermal and other treatments, polymorphism and isomorphism of certain typical para- and ferromagnetic bodies such as lepidocrocite, goethite, etc.

List of Papers published during the year

1. The behaviour of the paramagnetic ion in the single crystals of some similar salts of the iron group of elements I. Hydrated cupric salts—by A. Bose, S. C. Mitra and S. K. Datta, *Proc. Roy. Soc.*, **A239**, 165, 1957.

2. On the magnetic behaviours of some Cr+++ alums between 300°K to 100°K—by S. K. Dutta Roy, *Ind. Jour. Phys.*, **30**, 169, 1956.

3. The effect of long range crystalline electric fields on the magnetic anisotropy of the salts of Cu++ and Ni++ ions—by A. Bose, Magnetism, (Report of Symposium on Magnetism, Indian Association for the Cultivation of Science and Nat. Inst. Sciences of India), 1957, p. 49.

4. A study of the different methods of measurement of the susceptibility of dia- and paramagnetic solids—by S. K. Datta, do. do. p. 63.

5. An absolute method of measuring magnetic fields—by S. K. Dutta Roy, do. do. p. 11.

6. Free-electron diamagnetism and other allied properties in graphite—by A. K. Dutta, do. do. p. 147.

7. X-ray crystallographic study of the changes of Orthoboric acid during thermal treatment—by B. K. Banerji and D. R. Dasgupta, *Proc. Nat. Inst. Sci. Ind.*, **22**, 267, 1956.

8. Phase-transformation of borax during thermal treatment—by D. R. Dasgupta and B. K. Banerji, *Proc. Nat. Inst. Sci. Ind.*. **22**, 140, 1956.

9. Catalytic effect of TiO_2 and MnO_2 on the phase transformation of goethite—by S. C. Chakravarty and A. K. Roy, *Jour. Chem. Phys.*, **25**, 1079, 1956.

Paper in the Press

1. Paramagnetic behaviour of some salts of Iron group of elements—by A. Bose, Report of the Conference on Magnetism, Academy of Sciences, Moscow, U.S.S.R., 1956.

C. DEPARTMENT OF OPTICS

The problems investigated in this department during the year 1956-57 can be classified under the following headings:

(1) Raman spectra of aromatic compounds in the solid state at low temperatures;

(2) Raman spectra of frozen solutions of organic compounds at low temperatures;

(3) Raman spectra of organic compounds in the vapour state;

(4) Fluorescence of some organic compounds at low temperatures;

(5) Fluorescence of diamond excited by X-rays;

(6) Ultraviolet absorption spectra of organic compounds in different states and at different temperatures;

(7) Ultraviolet absorption spectra of frozen solutions of aromatic compounds;

(8) Crystal structure of some organic compounds at low temperatures;

(9) X-ray analysis of frozen solutions of organic compounds at low temperatures;

(10) X-ray analysis of jute fibre at low temperature.

Raman spectra of aromatic compounds in the solid state at low temperatures

In continuation of his previous investigations, D. C. Biswas studied the Raman spectra of acetophenone, phenetole and benzaldehyde in the solid state at low

temperatures. He observed that the first two compounds in the solid state produce new lines in the low frequency region, but the third one produces only a continuous wing. The dependence of the intensities and positions of these lines on temperature was also studied to understand the origin of these new lines.

Raman spectra of frozen solutions of aromatic compounds

The Raman spectra of frozen solutions of benzene in aliphatic solvents and of toluene and pyridine in ethyl alcohol at different temperatures have been studied by G. S. Kastha. He has observed that when 81% solution of toluene in ethyl alcohol is frozen it appears as a rigid glass, but a new band persists. In the case of frozen 35% solution this band spreads out into a continuous wing. The new low-frequency lines of crystals of benzene persist even in the case of 35% solution of benzene in ethyl alcohol and 18% solution in cyclohexane frozen and cooled to $-180°C$. These results have been interpreted on the assumption that the new lines are produced by groups of molecules which persist in the frozen solutions of benzene and are transformed into new groups each containing a few molecules of the solvent in the case of frozen solutions of toluene. The results obtained with the frozen solutions of pyridine in ethyl alcohol indicate that complex groups, each containing both pyridine and ethyl alcohol molecules, are frozen-in and produce a new band in place of several discrete lines produced by pure crystals of pyridine.

Raman spectra of organic substances in the vapour state

In continuation of his previous investigations Monomohan Mazumder has studied the Raman spectra of 1, 1-dichloroethane and 1, 1, 1-trichloroethane in the vapour state at temperatures above the respective boiling points. The results show that one half of the molecule in each case rotates freely about the bond connecting the two halves.

Fluorescence of some organic compounds at low temperatures

The fluorescence spectra of ortho-, meta- and para-bromotoluene and of ortho- and meta-chlorotoluene in the solid state at temperatures ranging from a few degrees below the freezing points upto $-180°C$ have been studied by D. C. Biswas. He has also investigated how the spectra are affected when these molecules are dispersed in frozen aliphatic and aromatic solvents. He has observed that only part of the fluorescence spectrum appears very feebly just below freezing point of each of these compounds, but at $-180°C$ the spectrum becomes richer in bands and the intensity increases enormously. It is also observed that the positions and relative intensities of the bands change differently when the molecules are dispersed in different frozen solvents. It has been concluded that the formation of weak bonds between the hydrogen atoms of the molecule and the halogen atoms of neighbouring molecules is responsible for the observed fluorescence.

Fluorescence of diamond excited by X-rays

S. N. Sen and B. M. Bishui have studied the fluorescence in seven specimens of diamond of different qualities using X-rays as exciting radiation. They have observed that continuous fluorescence is produced in all these specimens when excited by X-rays, the intensity being very small in the case of a diamond of Type II. They have concluded that besides the particular impurity which produces the fluorescence band at 4156 Å when excited by ultraviolet radiation there are also other impurities which produce the continuous fluorescence under X-ray excitation.

Ultraviolet absorption spectra of organic compounds in different states and at different temperatures

The ultraviolet absorption spectra exhibited by *p*-dimethoxy benzene, *m*-dichlorobenzene, *m*-bromotoluene, phenyl acetonitrile, phenyl acetate, phenyl salicylate, styrene, *o*-methoxy phenol and 2, 4, 6-trichlorophenol in liquid and solid states were investigated by S. K. Sen. In some cases splitting of the bands was observed when the substances were solidified and cooled to −180°C. The shifts of the bands from their positions in the spectra due to the substances in the vapour state were also determined.

Similar investigations have been carried out by S. B. Banerjee in the case of some isomeric picolines, ortho- and para-chloroanisole, phenol, o-bromophenol, diphenyl ether and pyridine. It has been observed that pyridine and the picolines in the vapour state show two systems of bands in the near ultraviolet region, but one of these disappears in the liquid and solid states. He has concluded from these results that the non-bonding electron of the nitrogen atom forms weak bonds with neighbouring molecules in the state of aggregation and so the band system due to $n \longrightarrow \pi$ transition disappears. Similar results are observed in the case of diphenyl ether also, but in this case the appearance of two systems of bands in the vapour state has been attributed to existence of two types of molecules.

He has observed a splitting of the bands with solidification of *o*-chloroanisole, but no such phenomenon occurs in the case of *p*-chloroanisole.

Ultraviolet absorption spectra of frozen solutions of organic compounds

In order to understand the reason for the splitting up of absorption bands into different components with solidification of some disubstituted benzenes S. B. Roy has undertaken a programme for investigating the absorption spectra of these compounds dispersed in rigid glass at −180°C with different concentrations. He has already studied these spectra due to solutions of ortho-, meta- and para-bromotoluene and of chlorotoluenes in isobutyl alcohol and the results show that the splitting of the bands observed in the case of crystals of the ortho and meta

compounds in the pure state at $-180°C$ does not take place when the molecules are dispersed in rigid glass with very small concentration. When the concentration in the rigid glass is raised the band system seems to be composed of two series of bands, one due to the single molecules showing no splitting and the other showing the splitting observed in the case of the pure crystals. He has concluded from these results that the splitting is due to presence of groups formed by the polar molecules in the crystal.

Similar investigations have been carried out in the case of the three dichlorobenzenes by S. B. Roy and S. C. Sirkar and the results obtained with *p*-dichlorobenzene have been discussed in the light of Davydov's theory. It has been concluded that in such chlorine substituted compounds the observed results are not explained satisfactorily by Davydov's theory.

Crystal structure of organic compounds at low temperatures

In order to understand the changes which the low frequency Raman lines of crystals of some aromatic compounds undergo with change of temperature of the crystal the Debye-Scherrer patterns of diphenyl at different temperatures including that of liquid oxygen were studied by G. S. R. Krishna Murti. He determined the dimensions of the unit cell at $-180°C$ and calculated the values of coefficient of expansion along the three crystallographic axes. The value of β was found to increase slightly at $-180°C$ probably due to slight reorientation of the molecules in the unit cell. He also studied in collaboration with S. N. Sen these patterns due to *p*-dichlorobenzene at $40°C$ and at different lower temperatures. At $40°C$ the crystal was found to belong to the triclinic system and below $40°C$ upto $-180°C$ to the space group C^5_{2h} in the monoclinic system. They concluded from the results obtained by them that the changes which take place in the Raman spectra with lowering of temperature of the crystal are due to reorientation of the molecules in the unit cell at low temperatures.

Krishna Murti has further studied the Debye-Scherrer patterns of anthracene at the temperatures of $80°C$, $55°C$, $32°C$ and $-180°C$ and has determined the dimensions of the unit cell at $-180°C$ and at $80°C$. It is found that β changes from $124°28'$ at $80°C$ to $125°10'$ at $-180°C$ and the coefficients of expansion along the three axes seem to be small in the range, $-180°C$ $-55°C$, but it increases ten times in the range, $55°C-80°C$.

X-ray analysis of frozen solutions of organic compounds

In order to understand the origin of new bands in the Raman spectra of frozen solutions of toluene in ethyl alcohol the Debye-Scherrer patterns of frozen toluene and of the solutions of toluence in ethyl alcohol of different concentrations, both in the liquid and solid states were studied by S. G. Biswas and S. C. Sirkar. The space group of the crystals of pure toluene at $-180°C$ was determined by applying Lipson's method and was found to be C^7_{2v}. The frozen solutions of

toluene in alcohol were found to be amorphous and the results indicated the presence of complex groups formed by interpenetration of toluene and ethyl alcohol molecules in the frozen mixture containing 81% of toluene and 19% of ethyl alcohol. It was concluded that the new band observed in the Raman spectra of these frozen solutions is due to these complex groups and is not due to crystal lattice.

X-ray analysis of jute fibre at low temperature

Sushil Kumar Chowdhury, one of the part-time honorary workers of this Department studied the diffraction pattern due to jute fibre kept at $-180°C$, using a low temperature Debye-Scherrer camera. He observed that the (101) and $10\bar{1}$) reflections were split up and the (002) spacing decreased slightly at low temperatures.

List of Papers published during the year 1956-57

1. On the crystal structure of paradichlorobenzene at different temperatures—by G. S. R. Krishna Murti and S. N. Sen, *Ind. J. Phys.*, **30**, 242, 1956.
2. On the dependence of intensity of fluorescence of frozen *p*-chlorotoluene on wavelengths of the exciting radiation—by D. C. Biswas, *Ind. J. Phys.*, **30**, 255, 1956.
3. Ultraviolet absorption spectra of frozen solutions of *o*-, *m*- and *p*-chlorotoluene in isobutyl alcohol—by S. B. Roy, *Ind. J. Phys.*, **30**, 276, 1956.
4. Raman spectra of frozen solutions of toluene and benzene in aliphatic solvents—by G. S. Kastha, *Ind. J. Phys.*, **30**, 313, 1956.
5. Ultraviolet absorption spectra of phenyl acetonitrile, phenyl acetate, phenyl salicylate and monomeric styrene in the liquid and solid states—by S. K. Sen, *Ind. J. Phys.*, **30**, 321, 1956.
6. Ultraviolet absorption spectra of phenol, *o*-bromophenol and diphenyl ether in different states —by S. B. Banerjee, *Ind. J. Phys.*, **30**, 353, 1956.
7. On the Raman spectra of 1, 1-dichloroethane and 1, 1, 1-trichloro-ethane in the vapour state—by Monomohan Mazumder, *Ind. J. Phys.*, **30**, 384, 1956.
8. On the fluorescence of para bromotoluene, ortho bromo- and ortho chlorotoluene in the solid state at low temperature—by D. C. Biswas, *Ind. J. Phys.*, **30**, 407, 1956.
9. Ultraviolet absorption spectra of pyridine in the liquid and solid states—by S. B. Banerjee, *Ind. J. Phys.*, **30**, 480, 1956.
10. Raman spectra of three monosubstituted benzene compounds in the solid state at low temperatures—by D. C. Biswas, *Ind. J. Phys.*, **30**, 530, 1956.
11. Raman spectra of pyridine and its solution in ethyl alcohol at different temperatures—by G. S. Kastha, *Ind. J. Phys.*, **30**, 519, 1956.
12. The crystal structure of anthracene at different temperatures—by G. S. R. Krishna Murti, *Ind. J. Phys.*, **30**, 537, 1956.
13. Ultraviolet absorption spectra of *o*-methoxy phenol and 2, 4, 6-trichlorophenol in different states—by S. K. Sen, *Ind. J. Phys.*, **30**, 553, 1956.
14. Fluorescence spectra of methyl benzoate, *m*-chlorotoluene and *m*-bromotoluene—by D. C. Biswas, *Ind. J. Phys.*, **30**, 565, 1956.

15. Ultraviolet absorption spectra of solutions of bromotoluenes in isobutyl alcohol at different temperatures—by S. B. Roy, *Ind. J. Phys.*, **30**, 590, 1956.

16. On the fluorescence in diamond excited by X-rays—by S. N. Sen and B. M. Bishui, *Ind. J. Phys.*, **30**, 620, 1956.

17. The crystal structure of diphenyl at different temperatures—by G. S. R. Krishna Murti, *Ind. J. Phys.*, **31**, 1, 1957.

18. Ultraviolet absorption spectra of isomeric picolines in the liquid and solid states—by S. B. Banerjee, *Ind. J. Phys.*, **31**, 11, 1957.

19. Ultraviolet absorption spectra of a few disubstituted benzenes in different states—by S. K. Sen, *Ind. J. Phys.*, **31**, 99, 1957.

20. Ultraviolet absorption spectra of ortho- and para-chloroanisole in the liquid and solid states—by S. B. Banerjee, *Ind. J. Phys.*, **31**, 135, 1957.

21. X-ray analysis of structure of toluene and its solution in alcohol at $-180°C$—by S. G. Biswas and S. C. Sirkar, *Ind. J. Phys.* **31**, 141, 1957.

Paper in the Press

1. On the ultraviolet absorption spectra of frozen solutions of dichlorobenzenes in isobutyl alcohol—by S. B. Roy and S. C. Sirkar, *Ind. J. Phys.*, **31**, 177, 1957.

D. DEPARTMENT OF THEORETICAL PHYSICS

The investigations carried out in the Department of Theoretical Physics during the year 1956-57 are mainly in the following lines:

(1) Sommerfeld's fine structure formula;

(2) Magnetic moments of the nucleons;

(3) P-P Scattering.

Sommerfeld's Fine Structure Formula

Dirac's first order equation gives the exact expression for the fine structure levels of the electron. If we operate twice the Dirac Hamiltonian for a free electron, we obtain the Klein-Gordon equation which does not show its spin characteristics; that is why the energy levels of an electron obtained from the second order Klein-Gordon equation do not agree with experimental values. However, when the electromagnetic interactions are introduced in the Dirac equation and we go over to the second order equation, certain additional terms appear in the expression for the interaction besides those which are of relativistic origin. C. C. Banerjee has shown that these extra terms in the second order equation give us, approximately, the fine structure formula of Sommerfeld which is not obtainable from the Klein-Gordon equation where electromagnetic interactions are introduced in the second order equation.

In a second paper C. C. Banerjee has shown that it is possible to obtain exactly Sommerfeld's fine structure formula from a second order equation which is a five dimensional analogue of the Klein-Gordon equation. The correct energy levels follow naturally from the solution of the five dimensional equation. It appears that the extra dimension takes into account in a way, not quite clear, the very effect of spin which is lacking in the four dimensional Klein-Gordon equation. The physical significance of the fifth coordinate and its relation, if any, to spin is under investigation.

Magnetic moments of the nucleons

The magnetic moments of the proton and the neutron are respectively 2·79 and −1·91 in nuclear magneton units, whereas according to Dirac theory they should be 1 and 0. To explain this anomaly, S. K. Kundu has proposed a classical model with spherically symmetric charge distribution. According to this picture, the magnetic moments arise from the distribution of charge due to the core of the nucleon and due to the meson cloud surrounding it. The observed magnetic moment of the proton is in essence a time average of two states: the state of being a proton and the state of dissociation into a neutron plus positively charged pseudoscalar meson. Similarly the magnetic moment of the neutron comes out only from its state of dissociation into a proton core and a negatively charged pseudoscalar meson. If we use the generally accepted value of the coupling constant ($f^2/\hbar_c \equiv 0{\cdot}058$) of the mesonic interaction and the cut-off limit ($5{\cdot}6\mu/\hbar_c$) for the momentum of the virtual meson, the theoretically calculated values ($\mu_P = 2{\cdot}87$, $\mu_N = -1{\cdot}73$) agree reasonably well with the experimental values.

P-P Scattering

With a view to investigating whether the introduction of higher singularity in the nuclear interaction term gives more isotropic scattering of protons by protons, A. Das has suggested a phenomenological potential of the form $(\sigma(1)\triangle)\ (\sigma(2)\triangle)\ e^{-xr}/_{r^2}$. Apart from the difficulty that the central force term leads to infinite scattering cross-section, the tensor force containing singularity of order higher than the usual pseudoscalar interaction does not give results superior to that obtained from the tensor part of the pseudoscalar theory.

List of Papers published during 1956-57

1. Sommerfeld's fine structure formula from a second order equation without Thomas correction—by C. C. Banerjee, *Ind. Jour. Phys.*, **30**, 525, 1956.
2. Sommerfeld's fine structure formula from five dimensional wave-equation—by C. C. Banerjee, *Ind. Jour. Phys.*, **31**, 242, 1957.

Papers in Press

1. Anomalous Magnetic Moments of Proton and Neutron—by S. K. Kundu, *Ind. Jour. Phys.*
2. On the p-p scattering at High Energies—by A. Das, *Ind. Jour. Phys.*

E. DEPARTMENT OF PHYSICAL CHEMISTRY

The investigations carried out in the department during the year under review may be classified under the following headings:—

A. High Polymers.

1. Kinetics of polymerization (methyl isopropenyl ketone and other monomers);
2. Preparation and polymerization of methacrylonitrile;
3. Kinetics of cross-linking during polymerization;
4. Studies in chain transfer;
5. Polymerization initiated by electrolysis of sodium acetate and soaps;
6. Built-in-dye polymers;
7. Thermodynamics of high polymer solution;
8. Determination of molecular weight, size and shape of high polymers;
9. Styrenation of shellac;
10. Determination of absolute rate constants in polymerization.

B. General Physical and Analytical Chemistry.

11. Interrelationship between physical properties of molecules;
12. Solubilization;
13. Non-aqueous titration.

C. Rubber.

14. Ozonization of vulcanized rubber;
15. Non-oxidative degradation of rubber.

High Polymer Chemistry

Kinetics of Polymerization (Methyl Isopropenyl Ketone and other monomers).

A new method has been devised by A. K. Chowdhury for the purification of methyl isopropenyl ketone. The study of the kinetics of polymerization of the purified monomer in different solvents has been completed and similar work in presence of initiators has been undertaken by him.

The polymerization of methylmethacrylate in presence of metallic soaps is being studied by V. Lingamurty.

Preparation and Polymerization of methacrylonitrile.

The preparation of methacrylonitrile by pyrolysing acetylated acetone-cyanhydrin has been successfully completed by K. K. Kundu. The study of kinetics of polymerization of the monomer is under investigation.

Kinetics of crosslinking during Polymerization.

Ethylene glycol diacrylate and ethylene glycol dimethacrylate have been synthesized by the esterification of glycol. These substances have been employed as crosslinking agent in the polymerization of styrene and acrylonitrile. Reactions were carried out at various concentrations of monomer and at different temperatures. The kinetics of polymerization is to be studied after hydrolyzing the crosslinked polymers.

Studies in Chain Transfer.

Studies in the polymerization of ethyl methacrylate in solution have been undertaken by S. R. Chatterjee with a view to comparing the effect of different groups, *e.g.*, methyl ethyl, butyl, nonyl and lauryl etc., on the polymerization kinetics and chain transfer reaction. The work is in progress.

Polymerization initiated by Electrolysis of Sodium Acetate and Soaps. ...

The free radicals obtained by the electrolysis of soaps have been utilized to induce the polymerization of methyl methacrylate by V. L. N. Murty. The polymeric products obtained were crosslinked and found to be insoluble in a large number of solvents. Further work is under investigation.

Built-in-dye Polymers.

The investigation on the preparation and properties of the built-in-dye polymers is being carried out by Bhaskara Rao. The work is in progress.

Thermodynamics of High Polymer Solution.

Heat of mixing of liquid hydrocarbons such as cyclohexane-chlorobenzne has been studied in the microcalorimeter constructed in this laboratory by S. K. Das and S. N. Bhattacharyya. Further studies with other similar pairs of substances are in progress.

Measurement of volume change on mixing of binary mixtures of nonpolar and slightly polar liquids has been undertaken by K. K. Kundu. The construction and standardization of one two-stemmed and another one-stemmed pykenometer have been completed in order to determine the densities of binary mixtures. The excess volumes of the following pairs of mixtures, *e.g.*, benzene+toluene,

toluene+xylene, benzene+P-xylene have been determined and are found to obey the laws of regular solutions approximately.

The work on the construction of a vapour pressure measuring instrument for binary mixtures has also been undertaken by S. N. Bhattacharyya. The construction of the equilibrium still and precision pressure measuring device in the range of 760 to 10 cm. has been completed.

Determination of Mol. Wt., size and shape of High Polymers.

The standardization of the light scattering apparatus constructed in this department is being continued by N. Sanyal.

This apparatus which has been constructed under the auspices of the Plastic Research Committee was exhibited at the "Symposium on High Polymers" held at the National Chemical Laboratory, Poona.

Determination of Absolute Rate Constant in Polymerization.

The apparatus using the rotating sector technique is under construction. Preliminary investigations on the dilatometric determination of rate of polymerization, the determination of initiation rate, etc., are being made by P. B. Roy Chowdhury and V. Lingamurty.

Styrenation of Shellac.

The work on the styrenation of shellac and also co-polymerization or combination of shellac with other monomer units has been continued by B. C. Rakshit. The results so far are disappointing and attempts are continued under changed conditions.

General Physical and Analytical Chemistry

Interrelationship between Physical Properties of Molecules.

The work on the relationship between physical properties and effective atomic numbers has been continued by G. R. Somayajulu. The effective atomic number correlates many physical properties such as boiling point, atomic size, ionic size, Van der Waal's volume, polarizability, refractivity etc. A relationship has also been found between atomic and ionic radii.

Solubilization.

The work on solubilization by cationic surface active agents is being continued by B. Biswas and V. A. Moghe. They found out a large number of liquid crystalline systems in course of their solubilization studies. Their optical, electrical and other properties are under investigation.

Non-aqueous titration.

A good number of titrations of acids and acid mixtures in glycolic medium have been carried out by Ch. Kalidas. A hydrogen electrode is being set up with a view to measuring the electrode potentials in non-aqueous media. A method for the estimation of cadmium in presence of mercury, both being present as halides is also being developed.

A method for the analysis of binary and ternary mixtures of sulphuric acid with strong as well as with weak acids has been worked out by M. N. Das and B. Mukherjee (on deputation from Central Leather Research Institute). A 2:1 mixture of ethylene glycol with dioxane, acetone or isopropyl alcohol serves as a suitable titration medium. Sodium hydroxide as well as piperidine has been used as the base.

A method has been developed for the estimation of cadmium as salicylaldoximate by non-aqueous titration.

(C) Rubber

Ozonolysis of vulcanized Rubber.

Ozonolytic degradation products of vulcanized rubber in chloroform is being analyzed and estimated by A. K. Sircar with a view to throwing some light on the mechanism of sulphur vulcanization.

Non-oxidative degradation of Rubber.

The degradation of natural rubber in absence of light and oxygen on continued stirring in carbon tetrachloride and the transfer of the radical formed with the solvent is being studied by A. K. Sircar and V. L. N. Murty. The work is in active progress.

List of Papers published during 1956-57

1. An absolute experimental test of the molecular weight distribution Equations of High Polymers—by S. R. Chatterjee and K. C. Mazumdar, *Proc. Nat. Inst. Sc. India,* **22,** 174, 1956.

2. The value of δ for Methyl Acrylate—by U. S. Nandi and S. R. Palit, *J. Polymer. Sci,* Dec., 1956.

3. Temperature Coefficients of Chain Transfer during Polymerization of Methyl Methacrylate —by J. N. Sen, S. Basu and S. R. Palit, *J. Sci. Ind. Res.,* **15B,** 481, 1956.

4. Boiling Point and Atomic Size—by G. R. Somayajulu and S. R. Palit, *Ind. J. Phys.,* **30,** 262, 1956.

5. Boiling Point and Physical Properties of Halogens and Halides—by G. R. Somayajulu, *Ind. J. Phys.,* **30,** 258, 1956.

6. Interrelationship between Viscosity and Boiling Point of Homologous Liquids—by S. R. Palit, *J. Chem. Soc.* (London), **539**, 2740, 1956.

7. A Note on the thermodynamic interpretation of Eötvos constant—by S. R. Palit, *Nature*, **177**, 1180, 1956.

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2. Boiling Points of Homologous Liquids—by G. R. Somayajulu and S. R. Palit, *J. Chem. Soc.* (London), 1957.

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5. Liquid Crystalline Cationic Soap Systems—by B. Biswas, V. A. Moghe and S. R. Palit, Presented at the Symposium of the National Institute of Sciences of India.

6. Studies on Synthetic Poly-electrolytes, Copolymers of Vinyl acetate-maleic acid and Vinyl alcohol maleic acid—by A. K. Sircar, Presented at the Symposium of the National Institute of Sciences of India.

F. DEPARTMENT OF ORGANIC CHEMISTRY

As reported in the previous report, investigations are being actively pursued in the field of alicyclic compound comprising sesquiterpenoids, diterpenoids, triterpenoids, and steroids and also in the field of heterocylics. Elucidation of the structure of some of the natural products is also in active progress.

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2. Sesquiterpenes and Related Substances—Part V--by P. C. Dutta, *ibid*, **33**, 885, 1956.

3. Synthetic Studies on dihydro-santonin—by Dutt and Dutta, *Chem. & Ind.*, 99, 1956.

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5. A Note on the occurrence of Ceryl alcohol in Argemone Mexicana—by Majumder, Sarkar and Dutta, *J. Ind. Chem. Soc.*, **33**, 351, 1956.

6. Synthetic Studies in Resin acids—by Ganguli, Saha and Dutta, *Chem. & Ind.*, 51, 1957.

7. Studies on the ultra-violet Absorption of Coumarins and Chromones Part 1—by Ganguli and Bagchi, *J. Org. Chem.*, **21**, 1415, 1956.

8. Synthesis of 1-Methyl and 1, 6-Dimethyl-3-methoxy -4-isopropyl-naphthalene—by P. B. Talukder, *J. Org. Chem.*, **21**, 506, 1956.

9. Synthesis of Condensed cyclic systems, *Science & Culture*, **21**, 545, 1956.

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3. Synthesis of a stereoisomer of $C_{12}H_8O_6$—a tricarboxylic acid from abietic acid—by Bagchi and Rao, *J. Org. Chem.*
4. Synthesis of Tubaic acid—by Ghosal and Bagchi, *J. Org. Chemistry.*

G. DEPARTMENT OF INORGANIC CHEMISTRY

Research works in this department have been mainly carried out on the study of metal complexes of organic ligands and their application in analytical chemistry.

Physicochemical studies on metal chelate complexes have also been carried out and their stability constants have been determined by spectrophotometric as well as by ion-exchange methods.

In continuation of his work on the metal complexes of hydroxamic acids, A. K. Chakraburtty has studied the metal complexes of glycol, lacto, thioglycol, thiosalicyl, cinnamyl and nitroso-malon hydroxamic acids. Of these, lacto-hydroxamic acid has been found to be formed *in situ* by the interaction of lactic acid and hydroxylamine in alkaline medium and has thus been advantageously used as a colorimetric reagent for copper, uranium, vanadium etc.

A. K. Chakraburtty has found in salicylhydroxamic acid a very useful reagent for gravimetric estimation of titanium and zirconium. He has also used benzo-hydroxamic acid for a similar purpose. He has utilized thiosalicylic acid as a reagent for the colorimetric estimation of uranium.

R. L. Dutta has completed his studies on the analytical uses of the pyridine hydroxamic acids. He has used picolino, isonicotino and quinaldino hydroxamic acids as colorimetric reagents for iron, vanadium, molybdenum and manganese. He has also completed the work on the analytical aspects of anthranilo-hydroxamic acid.

In continuation of his work on the silver specificity of benzimidazole, Dutta has also studied the usefulness of 2-mercaptobenzimidazole as a reagent for gravimetric estimation of silver.

In continuation of his physico-chemical studies on metal biguanide chelates, M. M. Ray has prepared and studied the properties of copper, nickel, cobalt and chromium complexes of benzyl biguanide. He has also prepared palladium complexes of ethylenedibiguanide and has been successful in isolating a dark coloured manganic complex with the same ligand.

Nihar Sengupta has prepared the copper, nickel, palladium and chromium complexes of ethanol biguanide. In addition to the usual mono- and bis-biguanides of copper, he has been able to prepare a new dark blue-coloured

complex of copper, which was found to be a binuclear complex of the di-ol type. The chromium complexes were of the hydroxoaquo bis.-biguanide type.

Bireswar Banerjee has completed his work on the preparation and properties of less familiar oxidation states of silver. He has also made a systematic spectrophotometric study on the ferrous complexes of pyridine and quinoline carboxylic acids including the determination of the stability constants of the complexes formed. He has found these useful for the spectrophotometric determination of traces of ferrous iron.

J. Xavier has completed his work on the analytical uses of rubeanic acid and its methyl, ethyl, 2-hydroxy-ethyl and benzyl derivatives as reagents for the spectrophotometric estimation of copper, nickel, cobalt and palladium. He has also used these reagents for determination of traces of ruthenium.

Asit Kumar Ray has determined the stability constants of the chloro-complexes of copper, nickel and cobalt by ion-exchange method. He has also used 8- and 5-aldehydo salicylic acids as reagents for the estimation of thorium.

S. N. Poddar has prepared and studied the properties of metal complexes of o-hydroxy dibenzoyl methane.

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2. A study on the metal complexes of ethylenediamine tetraacetic acid—by Rabindra Lal Dutta & Priyadaranjan Ray, *J. Ind. Chem. Soc.*, **33**, 727, 1956.
3. Detection of cobalt by o-pheylenediamine—by R. L. Dutta, *J. Ind. Chem. Soc.*, **34**, 151, 1957.
4. Complex compounds of bipositive silver with pyridine carboxylic acids, Part I—by Bireswar Banerjee and Priyadaranjan Ray, *J. Ind. Chem. Soc.*, **33**, 503, 1956.
5. Complex compounds of bipositive silver with pyridine carboxylic acid, Part II—by Bireswar Banerjee and Priyadaranjan Ray, *J. Ind. Chem. Soc.*, March Issue, **34**, 1957.
6. Substituted (ethyl, methyl and benzyl) rubeanic acids as colorimetric reagents—by J. Xavier and P. Ray, *Science and Culture*, **21**, 694, 1956.
7. Ethanol biguanide as a complexing ligand—by Nihar Sengupta and Priyadaranjan Ray, *Science and Culture*, **22**, 519, 1957.
8. O-hydroxy acetophenone oxime as an analytical reagent, Part I—by Sailendra Nath Poddar, *Z. anal Chem.*, **154**, 254, 1957.

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2. Do. Part II. Coloured complexes of iron, vanadium, and molybdenum with nicotine hydroxamic acid and their analytical uses—by R. L. Dutta, *J. Indian Chem. Soc.*
3. Biguanide sulphate as an acidimetric standard—by Asit Kumar Ray, *Z. anal. Chem.*
4. O-hydroxy acetophenone oxime as an analytical reagent, Part II—by S. N. Poddar, *Z. anal. Chem.*

P. Ray,
Officiating Director,

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2.	Swami Madhavananda & Ramesh Ch. Majumdar (Ed.).	Great Women of India.
3.	Townes, C. H. & Schawlow, A. L.	Microwave Spectroscopy.
4.	Zucrow, M. J.	Principles of jet propulsion and gas turbines.
5.	Stuart, H. A. (Ed.)	Ordnungszustande und umwandlungsers cheinungen in festen Hochpolymeren stoffen. (Band 3 of Die Physik der Hochpolymeren).
6.	Fleck, H. Ronald	Synthetic drugs.
7.	Saunby, T.	Soilless culture.
8.	Stevenson, L. G.	Nobel prize winners in medicine and physiology, 1901—1950.
9.	Steeds, W.	Engineering materials, machine tools and processes.
10.	West, T. F., Strausz, H. J., and Barton, D. H. R.	Synthetic perfumes.
11.	Urey, Harold C.	The planets. Their origin and development.
12.	Ott, Emil & Spurlin, H. R. (Ed.)	Cellulose and cellulose derivatives Part 3.
13.	Adam, Neil Kensington ...	Physical chemistry.
14.	Taylor, F. Sherwood	An illustrated history of science.
15.	Martin, G.	Industrial and manufacturing chemistry, Part I.
16.	Brooks, B. T.; Boord, C. E., Kurtz., S. S. & Schmerling, L. (Ed).	The chemistry of petroleum hydrocarbons vol. 1.
17.	—do— ...	do. do. vol. 2.
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19.	Halliday, David	Introductory nuclear, physics, 2nd edn.
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23.	Ketelaar, J. A. A.	Chemical constitution.
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30.	Farber, Eduard	Nobel prize winners in chemistry, 1901—1950.
31.	Noble, R. J.	Latex in industry, 2nd edition.
32.	Synge, J. L.	Relativity: the special theory.
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37.	Barron, Harry	Modern rubber chemistry, 2nd Edition.
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40.	Wadia, D. N.	Petroleum resources of India.
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42.	Coulson, C. A.	Valence.
43.	Ray, P. (Ed.)	History of chemistry in ancient and medieval India.
44.	Rowland, John	Ernest Rutherford atom pioneer.
45.	Clarke, H. T. (Ed.)	Ion transport across membranes.
46.	Madan, A. K.	The economic prospects of chemical industries in India.
47.	Green, Alex E. S.	Nuclear physics.
48.	Marshak, Robert E.	Meson physics.
49.	Hynek, J. A. (Ed.)	Astrophysics: a topical symposium.
50.	Evans, Robley D.	The atomic nucleus.
51.	Stacy, Ralph W.; Williams, D. T.; Worden, R. E. and McMorris, R. O.	Essentials of biological and medical physics.

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59. Palmer, W. G.	Experimental inorganic chemistry.
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124.	Bruce, F. R.; Fletcher, J. M.; Hyman, H. H.; & Katz, J. J.	Process chemistry, vol. 1.
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154.	Hershenson, Hezbert, M. ...	Ultraviolet and visible absorption spectra.
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236.	—do— ...	Selen. A. 1.
237.	—do— ...	Tellur, Sys. No. 11, 1940.
238.	—do— ...	Polonium und Isotope, Sys. No. 12, 1941.
239.	—do— ...	Hafnium, Sys. No. 43, 1941.
240.	—do— ...	Antimon, A. 2, 1940.
241.	—do— ...	Antimon, A. 1, 1940.
242.	—do— ...	Aluminium, A. 7, 1940.
243.	—do— ...	Antimon, B. 1.
244.	—do— ...	Iridium, Sys. No. 67, 1939.
245.	—do— ...	Magnesium, A. 3, 1942.
246.	—do— ...	Schwefel, A. 7, 1942.
247.	—do— ...	Sauerstoff, Sys. No. 3, Auf. 8, Lief. 1, 1943.
248.	Gmelins Handbuch der Anorganischen Chemie.	Zink: Erganzungsband, 8 Auf. Sys. No. 32, 1956.
249.	Hermann, C.; Lohrmann, O. & Philipp, H.	Strukturbericht, Bd. 2, 1928-32.
250.	Calcutta University	Minutes of the Syndicate, vol. 98, pt. 2, 1954.
251.	—do—	do. do. vol. 98, pt. 2, 1954 (2nd copy).
252.	—do—	do. do. vol. 98, pt. 3, 1954
253.	—do—	do. do. vol. 99, pt. 3, 1955.
254.	—do—	do. do. vol. 99, pt. 2, 1955.
255.	—do—	Calendar Supplement for 1953-54.
256.	—do—	Annual Report, 1954-55.

	Authors/Organizations.	Titles.
257.	United Nations	Peaceful uses of atomic energy. Proceedings of the International conference in Geneva, August, 1955, vol. 14.
258.	—do—	Do. vol. 15.
259.	—do—	Atom for peace manual.
260.	Landolt-Bornstein	Atom-und Molekularphysik, 2 Teil, Molekeln I.
261.	—do—	Eigenschaften der Materie in Ihren aggregatzustanden. 3 Teil, Band. 2.
262.	... ...	Proceedings Hamburg Congress on science and freedom.
263.	C. S. & I. R.	Radio Research Committee Council of Scientific & Industrial Research Progress Report, Sept., 1955—Feb., 1956.
264.	Calcutta University	Minutes of the Syndicate for the year, 1955, part 4.
265.	I. A. C. S.	Indian Association for the Cultivation of Science—Annual Report for 1955-56.
266.	... ...	Report on Progress in Physics, vol. 19, 1956.
267.	... ...	Nuffield Foundation 11th Report for the year ended 31st March, 1956.
268.	Vincent G. Callahan (pub.) ...	Atomic energy guidebook.
269.	C. S. & I. R.	Carbonization potentialities of certain M. P. coals.
270.	Ministry of Education Government of India	Indian National Commission for Co-operation with Unesco proceedings of the second conference, Feb. 6 & 7, 1956.
271.	L'U.R.S.I., Bruxelles ...	Joint Commission on Radio-meteorology proceedings of the third meeting held at Brussels, August 16-18, 1954.
272.	—do— ...	Mixed Commission on the Ionosphere: proceedings of the fourth meeting held in Brussels from August 16th to 18th, 1954.
273.	—do— ...	Indian National Scientific Documentation Centre Commonwealth Index of Transactions, 17th List, 1955.
274.	—do— ...	XIVth Japan Medical Congress, Parts 1 & 2, 1955.
275.	American Society for Testing Materials.	1952 Book of ASTM Standards—
276.	—do— ...	do. Pt. 2, Non-Ferrous Metals.
277.	—do— ...	do. Pt. 3, Cement, Concrete, Ceramics, etc.
278.	—do— ...	do. Pt. 4, Paint, Naval Stores, Wood, etc.
279.	—do— ...	do. Pt. 5, Fuels, Petroleum, Aromatic, etc.
280.	—do— ...	do. Pt. 6, Rubber, Plastics Electrical Insulation.
		do. Pt. 7, Textile, Soap, Water, etc.
281.	American Society for Testing Materials.	1953 Supplement to Book of ASTM Standards—
282.	—do— ...	do. Pt. 1, Ferrous Metals.
283.	—do— ...	do. Pt. 2, Non-Ferrous Metals.
284.	—do— ...	do. Pt. 3, Cement, Concrete, Ceramic, etc.
285.	—do— ...	do. Pt. 4, Paint, Naval Stores, Wood, etc.
286.	—do— ...	do. Pt. 5, Fuels, Petroleum, Aromatic, etc.
287.	—do— ...	do. Pt. 6, Rubber, Plastics, Electrical Insulation.
288.	—do— ...	do. Pt. 7, Textiles, Soap, Water, etc.
		1954 Supplement to Book of ASTM Standards—
289.	—do— ...	do. Pt. 1, Ferrous Metals.
290.	—do— ...	do. Pt. 2, Non-Ferrous Metals.
291.	—do— ...	do. Pt. 3, Cement, Concrete, Ceramics, etc.
292.	—do— ...	do. Pt. 4, Paint, Naval Stores Wood, etc.
293.	—do— ...	do. Pt. 5, Fuels, Petroleum, Aromatic etc.
294.	—do— ...	do. Pt. 6, Rubber Plastics, Electrical Insulation.
295.	John Wiley & Sons.	do. Pt. 7, Textiles, Soap, Water, etc.
		Abstracts of the literature on semiconducting and luminescent materials and their applications.
296.	Flugge, S. (Editor)	Handbuch der Physik Grundlagen der Optik Band, 24, 1956.
297.	Marks, Lionel S. (Editor) ...	Mechanical Engineers' Handbook, 5th Edition.
298.	Landolt-Bornstein	Astronomie und Geophysik, Band. 3, 1952.
299.	Flugge, S. (Editor)	Handbuch der Physik Geophysik 1 Band. 47, 1956.
300.	Wilson, A. J. C. (Gen.-Editor) ...	Structure Reports for 1942-1944, vol. 9.
301.	Clar, E.	Aromatiche Kohlenwasserstoffe.

JOURNALS SUBSCRIBED DURING 1956-57

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. Annales de Physique.
9. Annals of Mathematics.
10. Applied Scientific Research A. & B.
11. Astrophysical Journal.
12. British Journal of Applied Physics.
13. Bulletin of the Chemical Society of Japan.
14. Canadian Journal of Mathematics.
15. Chemical Abstracts.
16. Chemie Analytique.
17. Chemical Reviews.
18. Chemistry and Industry.
19. Comptes Rendus de Seances de L'Academie de Sciences.
20. Current Chemical Papers.
21. Discovery.
22. Discussions of the Faraday Society.
23. Electronics.
24. Engineers Digest.
25. Experientia.
26. Geophysics.
27. Isis.
28. Journal of the American Chemical Society.
29. Journal of Applied Chemistry.
30. Journal of Applied Physics.
31. Journal of Chemical Education.
32. Journal of Chemical Physics.
33. Journal of Chemical Society (London).
34. Journal of Colloid Science.
35. Journal of Electrochemical Society.
36. Journal of the Institute of Petroleum.
37. Journal of Inorganic & Nuclear Chemistry.
38. Journal of Nuclear Energy.
39. Journal of Organic Chemistry.
40. Journal of Physical Chemistry.
41. Journal of Polymer Science.
42. Machine Shop Magazine Monthly.
43. Mathematical Reviews.

44. Micro Chimica Acta.
45. Nature.
46. Nuclear Physics.
47. Nucleonics.
48. Philosophical Magazine.
49. Phil. Trans. Royal Society of London.
50. Physical Review.
51. Proc. National Academy of Sciences of U.S.A.
52. Proc. Physical Society, Sec. B.
53. Proc. Royal Inst. of Great Britain.
54. Proc. Royal Society of London, Sec. A.
55. Quarterly Reviews of Chemical Society.
56. Refrigeration Engineering.
57. Research.
58. Resins-Rubbers-Plastics.
59. Reviews of Modern Physics.
60. Rubber Chemistry & Technology.
61. Science Progress.
62. Scientific American.
63. Soviet Physics (JETP).
64. Textile Research Journal.
65. Trans. of American Mathematical Society.
66. Transactions of the Faraday Society.
67. Trans. of the Inst. of the Rubber Industry.
68. Vacuum.
69. Annual Reports on Progress in Physics.
70. Annual Reports on Progress of Chemistry.
71. Annual Review of Nuclear Science.
72. Annual Review of Physical Chemistry.
73. Annual Review of Bio-Chemistry.
74. Osiris.
75. Angewandte Chemie.
76. Annalender Chemie.
77. Chemische Berichte.
78. Helvetica Chemica Acta.
79. Journal Fur Praktische Chemie.
80. Kolloid Zeitschrift.
81. Kunststoffe.
82. Makromolekulare Chemie.
83. Naturwissenschaften.
84. Physikalische Berichte.
85. Seifen-Oele-Fette-Wachse.
86. Zeits. für Angewandte Physik.
87. Zeits. für Anorganische Chemie.

88. Zeits. für Astrophysik.
89. Zeits. für Elektrochemie und Angewandte Physikalische Chemie.
90. Zeits. für Kristallographie.
91. Zeits. für Naturforschung (A & B).
92. Zeits. für Physikalische Chemie.
93. Zeits. für Analytische Chemie.
94. Zeits. für Physik.

JOURNALS RECEIVED IN EXCHANGE DURING 1956-57

1. Acta Physica Academiae Scientiarum Hungaricae.
2. Acta Physica Polonica.
3. Agra University Journal of Research.
4. American Ceramic Society Bulletin.
5. Annalen der Physik.
6. Annales de la Faculties des Sciences de Marseille.
7. Annales de L'Institut Pasteur.
8. Annales de la Societe Scientifique.
9. Annual Report of the Bose Institute.
10. Applied Mechanics Reviews.
11. Archives des Sciences.
12. Arkiv for Fysik.
13. Arkiv for Matematik.
14. Australian Journal of Agricultural Research.
15. Australian Journal of Chemistry.
16. Australian Journal of Physics.
17. Bell Laboratory Record.
18. Biological Bulletin.
19. Boletin del Centro de Documentacion Cientifica Y Tecnica de Mexico.
20. Bulletin de L'Academie Polonaise des Sciences.
21. Bulletin of the Calcutta Mathematical Society.
22. Bulletin of G.S.I. and Records.
23. Bulletin Signaletique.
24. Chemist.
25. Communications from the Kamerlingh Onnes Laboratory of the University of Leiden.
26. Comptes Rendus de L'Academie Bulgare des Sciences.
27. Comptes Rendus des Travaux du Laboratoire Carlsberg Sr. Chimique.
28. Comptes Rendus des Travaux du Laboratoire Carlsberg Sr. Physiologique.
29. Current Science.
30. Czechoslovak Journal of Physics.
31. Det. Kgl. Danske Videnskabernes Selskab: Math-Fysiske Medd.
32. Do. Bio. Medd.

33. Det. Kgl. Danske Videnskabernes Selskab: Biologiske Skrifter.
34. Det. Kgl. Mat. Fys. Skr. Dan. Vid. Selsk.
35. Endeavour.
36. Geological Survey of India Library Bulletin.
37. Glasnik Matematicko-Fizicki I Astronomski.
38. Helvetica Physica Acta.
39. Indian Journal of Agricultural Science.
40. Indian Journal of Theoretical Physics.
41. Indian Minerals.
42. Industrial & Engineering Chemistry.
43. Insdoc List.
44. Insdoc Report.
45. Iowa State College Journal of Science.
46. Journal de Chmi. Phys. et de Physico-Chim-Bio.
47. Journal de Physique et le Radium.
48. Journal of American Ceramic Society.
49. Journal of the British Institute of Radio Engineers.
50. Journal of Franklin Institute.
51. Journal of Geophysical Research.
52. Journal of the Indian Chemical Society.
53. Journal of the Indian Institute of Science, A. & B.
54. Journal of Mathematics and Physics.
55. Journal of the Optical Society of America.
56. Journal of the Physical Society of Japan.
57. Journal of Research of National Bureau of Standards.
58. Journal of Royal Aeronautical Society.
59. Journal of Science Club.
60. Journal of Scientific & Industrial Research A.
61. Journal of Scientific & Industrial Research B. & C.
62. Journal of Scientific Instruments.
63. Journal of the Scientific Research Institute, Japan.
64. Koninklijke Nederlandse Akad. Van. Wet: Proc. A. (Math. Sci).
65. Koninklijke Nederlandse Akad. van Wet: Proc. B. (Physical Sci.).
66. Koninklijke Nederlandse Akad. van Wet: Proc. C. (Bio. & Medicine Sci.).
67. Kungl. Tekniska Hogskolans handlingar.
68. L'Ingenitur Revue Trimestrielle Canadienne.
69. Natur und Volk.
70. New Zealand Journal of Science & Technology B.
71. Nuclear Science Abstracts.
72. Osaka Mathematical Journal.
73. Philips Research Reports.
74. Philips Technical Review.
75. Physica.
76. Proc. Cambridge Philosophical Society.

77. Proc. Indian Academy of Science Sec. A.
78. Proc. Indian Academy of Science Sec. B.
79. Proc. of the Institution of Radio Engineers—Australia.
80. Proc. of the Japan Academy.
81. Proc. National Inst. of Sciences of India A. Physical Sci.
82. Proc. National Inst. of Sciences of India B. Biological Sci.
83. Proc. Physical Society A.
84. Proc. of the Royal Society of Edinburgh Sec. A.
85. Proc. of the Royal Society of Edinburgh Sec. B.
86. Progress of Theoretical Physics.
87. Quarterly Journal of The Royal Meteorological Society.
88. Rendiconti Instituto Superiore di Sanita.
89. Research Bulletin of the East Punjab University: Mathematics.
90. Research Bulletin of the East Punjab University: Botany.
91. Research Bulletin of the East Punjab University: Zoology.
92. Research Bulletin of the East Punjab University: Physics.
93. Research Bulletin of the East Punjab University: Chemistry.
94. Revue de Mathematiques et de Physique.
95. Review of the Polish Academy of Sciences.
96. Review of Scientific Instruments.
97. Revue de Physique.
98. Revue D'Optique.
99. Sankhya: Indian Journal of Statistics.
100. Science and Culture.
101. Science Reports of the Research Institute: Tohoku Univ. Sr. A.
102. Science Reports of the Tohoku University 1st Sr.
103. Scientia Sinica.
104. Scientific Proc. Royal Dublin Society.
105. Senckenbergiana Lethaea.
106. Senckenbergiana Biologica.
107. Societas Scientiarum Fennica: Commentationes Biologicae.
108. South African Journal of Science.
109. Tellus.
110. Tohoku Mathematical Journal.
111. Transactions Royal Society of Canada.
112. Viertelijahrsschrift der Naturforschenden Gesellschaft in Zurich.
113. Yokohama Mathematical Journal.
114. Zeit. fur Astrophysik.
115. Automatics & Tele-mechanics.
116. Colloids Journal.
117. Doklady Akad. Nauk SSSR.
118. Journal of Analytical Chemistry.
119. Journal Prikladnoi Chimii.
120. Prikladna Mechanika.

OTHER PUBLICATIONS RECEIVED AS COMPLIMENTARY ISSUES DURING 1956-57

1. Acta Astronomica.
2. Afinidad.
3. Arztliche Forschung.
4. Astrophysica Norvegica.
5. Atomic News Bulletin.
6. Bayerische Akademie der Wissenschaften: Math-Natur. W. Klasse.
7. Bulletin of the Inst. Nuclear Sciences. Boris Kidrich.
8. C. S. & I. R. News.
9. Central Glass & Ceramic Research Inst. Bulletin.
10. Ciba Medical Notes.
11. Commonwealth Scientific & Industrial Research Organisation: Annual Report.
12. Commonwealth Today.
13. The Deaf in India.
14. Education Abstracts.
15. French Economic and Technical Bulletin.
16. General Radio Experimenter.
17. Hewlett—Packard Journal (pamphlet).
18. Half-yearly Journal of Mysore University A.
19. Hilger Journal.
20. Indian Journal of Meteorology & Geophysics.
21. Indian Journal of Physics.
22. Ionospheric Data.
23. Ionospheric Predictions.
24. Istanbul Teknik Universitiel Bulteni.
25. Journal of Association of Applied Physists, C. U.
26. Journal of College of Engineering & Technology, Bengal.
27. Journal of the Inst. of Polytechnics Osaka City University Sr. A.
28. Journal of the Leather Technologists Association (India).
29. Journal of Mechanical Laboratory of Japan.
30. Journal of Science of the Hiroshima University Sr. A.
31. Journal of Technology, B. E. College.
32. Kumamoto Journal of Science Sr. A.
33. Kungl. Vetenskaps-Societetens Arsbok.
34. Memoirs of Faculty of Technology.
35. Natural Science Report of the Ochanomizu University.
36. Notas de Fisica.
37. Philips Industrial & Electronic Bulletin.
38. Philips Serving Science & Industry.
39. Report of the Commonwealth Astronomer.
40. Reports of the Liberal Arts Faculty, Shizuoka University Sr. A.
41. Research Industry.
42. Research Reports of the Institute of Radio Physics and Electronics.
43. Samvadadhvam.

44. Scientific Papers of the College of General Education, University of Tokyo.
45. Science of Light.
46. Siemens Review.
47. Siemens Zeitschrift.
48. Spanish Cultural Index.
49. Technical Education News.
50. Transactions of the Bose Research Institute.
51. Transactions of the Indian Inst. of Chemical Engineers.
52. Unesco Bulletin for Libraries.
53. Unesco Chronicle.
54. University of Illinois Engr. Experiment Station.
55. Univ. Nacional de la Plata Facultad de Ciencias Fisicomatematicas. Serie Segunda, Dept. Math.
56. WHO Bulletin.
57. Avtomaticheskai Svarua.
58. Referativnii Zhurnal Phizika.
59. Referativnii Zhurnal Chimia.
60. Trudi Institute Kristallografii.
61. Trudi Fizicheskogo Institute.
62. Visnik Akademia Nauk SSSR.
63. Zhurnal Experimentalnoi Teoreticheskoi Fiziki.
64. Zhoornoal Fizichyeskoi Himu.
65. Zhurnal Technicheskoi Fiziki.

BUDGET ESTIMATES, BALANCE SHEET AND STATEMENT OF ACCOUNTS

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

BUDGET ESTIMATES—1957-58

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

RECEIPTS

Heads of Receipts	Actual for 1955-56	Budget Original 1956-57	Revised Budget 1956-57	Budget Estimates 1957-58	Remarks
I. Govt. of India					
(1) Grant-in-aid	4,83,465	7,28,943	6,51,500	7,35,136	
(2) Contribution to D.A.	24,173	36,447	32,570	36,756	
II. Govt. of West Bengal					
(1) Grant-in-aid	—	1,31,650	90,629	1,26,783	
III. Other Receipts					
(1) Interest from General Fund	2,184	500	500	500	
(2) Ordinary Membership Subscription	965	1,200	1,000	1,200	
(3) Life Membership Fee	—	1,000	1,000	1,000	
(4) Indian Journal of Physics	7,405	12,000	10,000	8,000	
(5) Miscellaneous	285	500	500	500	
(6) Sale of Monographs etc.	586	100	400	500	
(6a) Bijnaner Itihas	3,794	—	3,000	3,500	
IV. Contribution from M.L.S. & V.L.M. Professorship Fund	16,840	8,420	8,420	8,420	
V. Amount carried over from previous year for meeting outstanding liabilities	18,998	36,554	36,554	52,807	
	5,58,695	9,57,314	8,36,073	9,75,102	
Surplus ...	—	—	2,026	1,987	
Total Rs. ...	5,58,695	9,57,314	8,34,047	9,73,115	

Total Rs. ...	5,58,695	9,57,314	8,34,047	9,73,115

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

BUDGET ESTIMATES—1957-58—RECURRING— GENERAL SUMMARY

(Excluding CSIR Schemes, Scientific Man Power Committee Scheme etc.)

EXPENDITURE

Heads of Expenditure	Actuals for 1955-56	Original Budget 1956-57	Revised Budget 1956-57	Budget Estimates 1957-58	Remarks
I. Establishment					
1. Salary					
Director and his staff—Existing	28,220	31,221	24,542	25,233	
Department of Central Scientific Services under the 5-yr. Plan	—	14,400	1,098	5,910	
Department of General Physics & X'rays—Existing	41,121	22,843	23,011	21,618	
Do. New posts under 5-yr. Plan ...	—	18,900	6,494	17,560	
Department of Magnetism—Existing	—	15,880	13,811	15,600	
Do. New posts under 5-yr. Plan ...	—	16,500	7,602	14,954	
Department of Optics—Existing	36,091	31,239	31,570	30,397	
Do. New posts under 5-yr. Plan ...	—	11,055	5,213	9,615	
Department of Theoretical Physics—Existing ...	25,333	22,850	21,780	22,756	
Do. New posts under 5-yr. Plan ...	—	22,800	4,800	15,600	
Department of Physical Chemistry—Existing ...	33,036	32,750	31,443	33,658	
Do. New posts under 5-yr. Plan ...	—				
(*a*) General Physical Chemistry ...	—	9,900	3,450	10,020	
(*b*) Technological Applications of High Polymers—Rubber Section	—	30,060	9,151	21,660	
(*c*) Plastic & Resin Section ...	—	—	—	5,160	
Department of Organic Chemistry—Existing ...	35,134	30,254	29,310	30,413	
Do. New posts under 5-yr. Plan ...					
(*a*) General Organic Chemistry ...	—	15,600	3,427	16,560	
(*b*) Training in High Polymers ...	—	13,800	5,102	14,520	
Department of Inorganic Chemistry—Existing ...	31,127	26,646	22,634	28,254	
Do. New posts under 5-yr. Plan—Analytical Laboratory	—	8,040	1,520	9,960	
Library—Existing	7,619	4,894	5,895	5,099	
Do. New posts under 5-yr. Plan	—	4,200	320	960	
Workshop—Existing	23,894	16,633	16,878	16,276	
Do. New posts under 5-yr. Plan ...	—	15,000	3,657	8,688	
Indian Journal of Physics	5,064	5,225	4,554	4,442	including D. A.
Carried over ...	2,66,639	4,20,690	2,77,262	3,84,913	

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE—EXPENDITURE (*Contd.*)

Heads of Expenditure	Actuals for 1955-56	Original Budget 1956-57	Revised Budget 1956-57	Budget Estimates 1957-58	Remarks
Brought Forward ...	2,66,639	4,20,690	2,77,262	3,84,913	
Administration—Existing	43,956	30,458	34,246	30,427	
Do. New posts under 5-yr. Plan ...	—	6,600	3,554	7,812	
Do. Publication Section under 5-yr. Plan	705	3,025	2,090	1,810	
Previous Year's liability	—	1,293	1,293	—	
2. (*a*) Dearness Pay—Existing	—	27,378	8,480	25,964	
Do. New posts under 5-yr. Plan ...	—	23,850	4,920	20,255	
(*b*) Dearness Allowance—Existing	—	31,958	31,285	33,164	
Do. New posts under 5-yr. Plan ...	—	23,850	8,187	20,255	
3. Provident Fund—Existing	18,086	19,549	17,834	19,089	
Do. New posts under 5-yr. Plan ...	—	11,407	2,618	9,853	
Previous years' liability	—	991	991	3,126	
4. House Rent Allowance—Existing	—	—		16,716	
Do. New posts under 5-yr. Plan ...	—	—		12,757	
Additional demand for posts previously excluded from the priority list, but included in the original Budget Estimates	—	—	19,326	—	
	3,29,386	6,01,049	4,12,086	5,86,141	
II. Laboratory Grants					
Dept. of Central Scientific Services					
Recurring	602	10,000	10,000	10,000	
Special	—	—	—	—	
Previous years' liabilities	—	1,138	1,138	1,418	
Dept of General Physics & X-rays					
Recurring	6,382	12,000	12,000	12,000	
Special	—	—	6,000	—	
Previous years' liabilities	1,042	7,347	7,347	2,895	
Carried over ...	3,37,412	6,31,534	4,48,571	6,12,454	

... ...	1,042	7,347	7,347	2,895	
Carried over ...	3,37,412	6,31,534	4,48,571	6,12,454	

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE—EXPENDITURE (*Contd.*)

Heads of Expenditure	Actuals for 1955-56	Original Budget 1956-57	Revised Budget 1956-57	Budget Estimates 1957-58	Remarks
Brought Forward ...	3,37,412	6,31,534	4,48,571	6,12,454	
Dept. of Magnetism					
Recurring	—	12,000	12,000	12,000	
Special	1,778	—	6,000	—	
Previous years' liabilities	—	—	—	4,152	
Dept. of Optics					
Recurring	7,375	12,000	12,000	12,000	
Special	—	—	6,000	—	
Previous years' liabilities	—	480	480	3,355	
Dept. of Theoretical Physics					
Recurring	1,187	3,000	3,000	3,000	
Special	—	—	2,000	—	
Previous years' liabilities	—	200	200	1,722	
Dept. of Physical Chemistry					
Recurring	10,192	12,000	12,000	18,000	
Special	—	—	6,000	—	
Previous years' liabilities	99	734	734	1,232	
Dept. of Organic Chemistry					
Recurring	11,984	18,000	18,000	18,000	
Special	1,732	—	6,000	—	
Previous years' liabilities	155	796	796	315	
Dept. of Inorganic Chemistry					
Recurring	9,386	18,000	18,000	18,000	
Special	—	—	6,000	—	
Previous years' liabilities	500	766	766	7,515	
III. Library					
Recurring	15,903	21,000	21,000	21,000	
Special	1,381	—	5,000	—	
Previous years' liabilities	—	3,460	3,460	1,052	
Carried over ...	3,99,084	7,33,970	5,88,007	7,33,797	

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE—EXPENDITURE (*Contd.*)

Heads of Expenditure	Actuals for 1955-56	Original Budget 1956-57	Revised Budget 1956-57	Budget Estimates 1957-58	Remarks
Brought Forward ...	3,99,084	7,33,970	5,88,007	7,33,797	
IV. Workshop					
Recurring	7,808	15,000	15,000	15,000	(1) Including cost of publication of late Prof. Saha's collected works.
Special	—	—	10,000	—	
Previous years' liabilities	46	240	285	9,074	
V. Indian Journal of Physics					
Publication Expenses	18,520	16,000	18,000	16,000	(2) For details see page 51 & 52.
Previous years' liabilities	265	305	305	83	
VI. (a) Publication Expenses (General)					
Publication Expenses	3,810	17,500	17,500	15,000 (1)	(3) Payment of interest only.
Previous years' liabilities	1,908	11,847	11,847	3,284 } 700 }	
(b) To Bijnaner Itihas Fund	—	—	3,000	3,500	(4) Payment of loan (part) & interest, as per recommendation of the Finance Committee dated 10-8-56 and Council dated 18-8-56.
VII. To Life Membership and Institutional Membership Fund	—	1,000	1,000	1,000	
VIII. Laboratory Services, General Expenses and Miscellaneous including previous years' liabilities	73,877	1,48,419	1,54,103	1,60,677 (2)	
IX. Suspense, Advances, (excluding those under construction, equipments, non-rec. etc.) ...	27,625	—	—	—	
X. Part repayment of loan and interest	7,164 (3)	3,500 (3)	10,000	10,000 (4)	
XI. Provision for enabling members of Research Departments to attend meetings, conferences and spend some time at Research Institutes in foreign countries ...	—	10,000	5,000	5,000	
TOTAL RS. ...	5,40,107	9,57,781	8,34,047	9,73,115	

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

BUDGET ESTIMATES—1957-58

(Laboratory Expenses and General Services)

Heads of Expenditure	Actuals for 1955-56	Original Budget Estimates 1956-57	Revised Budget 1956-57	Budget Estimates 1957-58	Remarks
1. Building Maintenance A/c. (Depreciation Fund) ...	16,400	51,800	45,360	47,300*	* The calculation is based on 2% on the Building and 5% for Electrical, Sanitary and Gas and laboratory installations and fittings as follows:—
2. Electric Fittings	3,437	4,000	4,000	4,000	
Do. Revoted	1,085	—	3,685	—	
Previous year's liability	—	3,685		—	
3. Furniture	10,486	5,000	15,000	6,000	
Previous year's liability		1,917	1,917	10,006	
4. Gas	3,363	4,000	4,000	4,000	
Previous year's liability				525	
5. Electricity	8,545	9,500	9,500	9,500	
6. Telephone	1,588	1,200	2,100	2,000	
7. Printing—Letter heads, forms, Ledger, etc. ...	640	2,400	1,000	2,000	
Previous year's liability	—	659	659	282	
8. Stationery & Contingency	6,075	6,500	6,500	7,000	
Previous year's liability	—	461	461	67	
9. Postage	1,885	1,600	3,600	2,500	
10. Advertisement	2,396	2,500	3,500	2,500	
Do. Revoted	28				
11. Municipal Tax	1,623	2,500	1,624	1,700	
12. Audit Fee	650	1,000	1,000	1,000	
Do. Revoted	250				
13. Insurance Premium	619	1,000	1,000	1,000	
14. Meeting Expenses	321	750	750	750	
15. Indian Science Congress Association Subscription ...	12	12	12	12	
16. Travelling Expenses for attending Council and meetings, etc.	4,812	5,000	5,000	5,000	
17. Bank Charges	132	100	100	150	
18. Contribution to the Indian Science News Association	1,000	1,000	1,000	1,000	
Carried Over ...	65,347	1,06,584	1,11,768	1,08,292	

Electrical Fittings ...	1,30,285
Sanitary & Gas Fittings	71,177
Water Softener Plant ...	10,925
Laboratory fittings & Furniture	1.16,626
Lift	28,063
Transformer & Rectifier	52,234
	4,09,310
5% of 4,09,310 ...	20,466
2% of 13,41,813 ...	26,836
	47,302
Say,	47,300

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

BUDGET ESTIMATES—1957-58 —*Contd.*

Heads of Expenditure	Actuals for 1955-56	Original Budget Estimates 1956-57	Revised Budget 1956-57	Budget Estimates 1957-58	Remarks
Brought Forward ...	65,347	1,06,584	1,11,768	1,08,292	
19. Motor Van Up-keep	4,056	3,500	3,500	4,000	
Previous year's liability				36	
20. Miscellaneous	3,953	4,000	7,000	4,500	
Previous year's liability	—	235	235	1,969	† As per balance sheet as at March 31, 1956 and income and expenditure account for the period ending March 31, 1956.
21. Provision for leave salaries, allowances, higher salaries, etc.	521	3,500	1,000	3,500	
22. Contribution to a Depreciation Fund for Scientific Instruments equipments	—	30,000	30,000	30,080†	
23. Provision for Medical Benefit to Employees ...	—	—	—	5,000‡	‡ As per recommendation of the Council dated May 4, 1956.
24. Provision for P. Fund benefit to Employees (Bearers, peons and like staff)	—	—	—	2,000	
25. Contribution to Association Canteen	—	600	600	600	
26. Contribution to Science Association Club ...	—	—	—	100	
27. Meghnad Saha Memorial Gold Medal	—	—	—	600	
TOTAL Rs. ...	73,877	1,48,419	1,54,103	1,60,677	

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

Budget Estimates (Non-recurring for 1957-58 for building construction, purchase of equipments and reference books etc.)

Receipts

	Rs.
Government of India Grant—	
Building Construction, L.A. charges etc.	5,34,666
Equipments, reference books etc.	4,41,100
Government of India, Loan for construction of Hostel	1,11,000
Government of West Bengal Grant—	
Building Construction	2,38,334
Equipments, reference books etc.	2,20,550

Expenditures

Building Programmes—	
Construction of additional floors to the main building (contd. from previous year)	3,30,000
Sanitary, electrical and gas connections, roads, drains etc.	2,05,000
Laboratory benches and general furniture	1,80,000
Towards establishment charges in connection with the land acquisition at Jadavpur	13,000
Purchase of package type refriegerating units for air-conditioning the dark rooms and rooms for housing special equipments	45,000
	7,73,000
Construction of hostel (1st & 2nd storeys)	1,11,000

Equipments and Reference Books

Department	*Allotment*	*Govt. of India share*	*Govt. of West Bengal share*
Central Scientific Services	1,03,500	69,000	34,500
General Physics & X-rays	85,150	56,767	28,383
Magnetism	71,350	47,567	23,783
Optics	1,21,400	80,934	40,467
Theoretical Physics	—	—	—
Physical Chemistry	98,900	65,934	32,967
Organic Chemistry	11,500	7,667	3,833
Organic Chemistry—High Polymer.	69,000	46,000	23,000
Inorganic Chemistry	30,500	20,334	10,167
Workshop	25,400	16,934	8,467
Library	17,350	11,567	5,783
Administration	27,600	18,400	9,200
	6,61,650	4,41,104	2,20,550

INDIAN ASSOCIATION

Balance Sheet

LIABILITIES			Rs.	As.	P.	Rs.	As.	P.
General Fund—								
Brought Forward	33,64,722	6 7						
Less Adjustments for previous year	3,069	2 0						
	33,61,653	4 7						
Add Cheque issued in previous year cancelled this year	452	14 0	33,62,106	2	7			
Add Grants from Government of India (Non-Recurring & Equipment)	3,60,000	0 0						
Add Grants from Government of West Bengal (Non-Recurring & Equipment)	2,72,000	0 0	6,32,000	0	0			
			39,94,106	2	7			
Less Transferred to Building Maintenance Fund			45,360	0	0			
			39,48,746	2	7			
Add Excess of Income over Expenditure this year			1,28,332	12	11			
						40,77,078	15	6
Life & Institutional Memberssip Fund:								
Brought Forward			...			30,130	15	0
Building Maintenance Fund:								
Brought Forward			76,399	14	0			
Add Amount transferred from General Fund this year			45,360	0	0			
						1,21,759	14	0
Depreciation Fund:								
Amount provided this year			...			95,211	6	8
Dr. M. N. Saha Memorial Fund			...			14,879	0	0
Grant from Government of West Bengal for Publication of History of Science:								
Brought Forward ...	5,136	14 6						
Add Sale Proceeds of Books ("Bijnaner Itihas")	5,247	6 6	10,384	5	0			
Less Expenses this year			2,539	14	9			
						7,844	6	3
Carried Over ...			...			43,46,904	9	5

FOR THE CULTIVATION OF SCIENCE

as at 31st March, 1957.

ASSETS	Rs.	As.	P.	Rs.	As.	P.
Fixed Assets:						
(Other than Laboratory Fittings & Scientific Instruments)						
As per Schedule "A"	...			29,75,160	3	8
Laboratory Fittings & Scientific Instruments						
As per Schedule "B"	...			5,78,354	3	6
Investments—on account of Special Funds lodged with State Bank of India						
As per last account:—						
Mahendra Lal Sarkar Professorship Fund						
3% Conversion Loan 1946, at Face Value	1,49,500	0	0			
Vihari Lal Mitra Fund						
3% Conversion Loan, 1946 at Face Value	1,32,000	0	0			
Ripon Professorship Fund						
3% Loan 1896-97 at Face Value 4,000 0 0						
3% Conversion Loan 1946 at Face Value 21,000 0 0	25,000	0	0			
Hare Professorship Fund						
3% Conversion Loan 1946 at Face Value	1,500	0	0			
Cooch Behar Professorship Fund						
3% Conversion Loan 1946 at Face Value	33,000	0	0			
Victoria Professorship Fund						
3% Conversion Loan 1946 at Face Value	1,500	0	0			
Joy Kissen Mukherjee Gold Medal Fund						
3% Conversion Loan 1946 at Face Value	13,400	0	0			
Dr. Bimala Charan Law Gold Medal Fund						
3% 1st Development Loan 1970-75 at Face Value 2,000 0 0						
3% Conversion Loan 1946 at Face Value 5,000 0 0	7,000	0	0			
Dr. Sircar Research Medal Fund						
3% Conversion Loan 1946 at Face Value	5,000	0	0			
Woodburn Medal Fund						
3% Conversion Loan 1946 at Face Value	1,500	0	0			
Nikunja Garabini Prize Fund						
3% Conversion Loan 1946 at Face Value	1,000	0	0			
Carried Over ...	3,70,400	0	0	35,53,514	7	2

INDIAN ASSOCIATION

Balance Sheet

LIABILITIES	Rs.	As.	P.	Rs.	As.	P.
Brought Forward ...		...		43,46,904	9	5
Special Funds:						
Mahendra Lal Sarkar Professorship Fund	1,49,500	0	0			
Vihari Lal Mitra Fund	1,00,000	0	0			
Ripon Professorship Fund	25,000	0	0			
Hare Professorship Fund	1,500	0	0			
Cooch Behar Professorship Fund ...	33,000	0	0			
Victoria Professorship Fund	1,500	0	0			
Joy Kiseen Mukherjee Gold Medal Fund ...	13,400	0	0			
Dr. Bimala Charan Law Gold Medal Fund	7,000	0	0			
Dr. Sircar Research Medical Fund ...	5,000	0	0			
Woodburn Medal Fund	1,500	0	0			
Nikunja Garabini Prize Fund	1,000	0	0			
Jatindra Chandra Prize Fund	1,000	0	0			
Building Fund	9,500	0	0			
				3,48,900	0	0
Library Deposits		...		190	0	0
Amounts due to						
C. S. I. R. Employees Provident Fund ...	12	0	0			
I. C. A. R. Employees Provident Fund ...	103	2	0			
M. L. S. Prof. Fund, Brought Forward ...	1,000	0	0			
Staff Provident Fund	217	13	0			
Staff for Scholarship	598	0	0			
Staff for Salary	1,017	6	0			
				2,948	5	0
Loans from Government of India						
Secured against Land & Buildings per Contra)						
Brought Forward	3,50,000	0	0			
Less Refunded	6,500	0	0			
				3,43,500	0	0
Advance & Suspense						
As per list		...		2,150	12	0
Amounts due to C. S. I. R.						
(*a*) Scheme for Construction of Osmometer suitable for High Polymer Research						
Brought Forward	77	2	6			
(*b*) Scheme—Thermal Diffusion & Inter Diffusion of Gases						
Brought Forward 812 4 9						
Add Grants Received 4,257 13 0						
5,070 1 9						
Less Expenses this year 4,617 5 0	452	12	9			
Carried Over ...	529	15	3	50,44,593	10	5

FOR THE CULTIVATION OF SCIENCE

as at 31st March, 1957.—(Contd.)

ASSETS	Rs.	As.	P.	Rs.	As.	P.
Brought Forward ...	3,70,400	0	0	35,53,514	7	2
Jatindra Chandra Prize Fund						
3% Conversion Loan 1946 at Face Value	1,000	0	0			
General Fund						
3% Conversion Loan 1946 at Face Value	16,500	0	0			
Building Fund						
3% Conversion Loan 1946 at Face Value	9,500	0	0			
				3,97,400	0	0
Security Deposits						
Brought Forward						
Calcutta Electric Supply Corporation Ltd. ...	1,597	12	9			
Oriental Gas Co. Ltd.	40	0	0			
Thomas Cook ...	150	0	0	...		
				1,787	12	9
Advance & Suspenses						
As per list						
Building Extension	81,801	8	0			
UNESCO Book Coupons	29,882	13	0			
Staff & Others	11,098	8	7			
				1,22,782	13	7
Amount due from C.S.I.R. for						
(*a*) Scheme for construction of Light Scattering Aparatus, etc., B.F. ...	33	6	0			
Expenses this year	6,646	2	9			
	6,679	8	9			
Less Grants Received	6,389	4	0			
				290	4	9
(*b*) Synthetic Studies in deterpenoid resin acids						
Expenses this year	3,605	4	9			
Less Grants Received	1,520	0	0	2,085	4	9
				2,375	9	6
Amounts due from Special Funds						
Joy Kissen Mookherjee Gold Medal Fund				1,212	4	3
Cooch-Behar Professorship Fund ...				390	4	9
M. L. S. Professorship Fund				100	8	0
B. C. Law Gold Medal Fund				349	13	6
Ripon Professorship Fund				2,250	0	0
				4,302	14	6
Amount due from I.C.A.R.						
Expenses incurred for Synthetic Polyelectrolytis				...		
				2,250	0	0
Carried Over ...				...		
				40,84,413	9	6

INDIAN ASSOCIATION

Balance Sheet

LIABILITIES		Rs. As. P.	Rs. As. P.
Brought Forward ...		529 15 3	50,44,593 10 5
(*c*) Scheme—Mutual Solubulization of Oil & Water			
Brought Forward	116 5 6		
Add Grants Received	4,101 11 0		
	4,218 0 6		
Less Expenses this year	3,230 0 0	988 0 6	
(*d*) Scheme—Crystal Structure of Frozen Organic Liquids at Low Temperature			
Brought Forward	452 13 0		
Add Grants Received	4,050 13 6		
	4,503 10 6		
Less Expenses this year	3,804 2 0	699 8 6	
(*e*) *Scheme—Thermodynamic Properties etc.*			
Debit Balance, Brought Forward ...	235 7 3		
Add Expenses this year	8,762 0 0		
	8,997 7 3		
Less Grants Received	9,478 10 0	481 2 9	
(*f*) Absolute Value of Rate Constant in Polymerisation			
Grant Received	11,900 0 0		
Less Expenses this year	278 14 3	11,621 1 9	
			14,319 12 9
Government of India—Natural Research Fellowship			
Grant Received this year		6,832 4 0	
Less Debit Balance Brought Forward	632 4 0		
Expenses this year	5,765 9 0	6,397 13 0	
			434 7 0
Carried Over ...		...	50,59,347 14 2

FOR THE CULTIVATION OF SCIENCE

as at 31st March, 1957.—(Contd.)

ASSETS	Rs.	As.	P.	Rs.	As.	P.
Brought Forward	...			40,84,413	9	6
Grants receivable from Government of West Bengal						
Non-Recurring	1,36,000	0	0			
Recurring	56,000	0	0			
				1,92,000	0	0
Cash Balances						
Imprest Cash	1,300	0	0			
In Hand including Cheques	1,79,931	6	0			
At State Bank of India on Current Account Jadavpur	76,498	1	6			
Do. Head Office	3,44,197	7	11			
At Bank for Depreciation Fund ...	30,000	0	0			
Do. for Building Maintenance Fund	1,21,759	14	0			
Do. for Life & Institutional Membership Fund	30,130	15	0			
				7,83,817	12	5
Carried Over				50,60,231	5	11

INDIAN ASSOCIATION

Balance Sheet

LIABILITIES	Rs.	As.	P.	Rs.	As.	P.
Brought Forward			...	50,59,347	14	2
Indian Lac Cess Committee—Scheme for Styrenation of Shellac						
Grant Received during the year	3,400	0	0			
Less Expenses during the year	2,516	8	3	...	883	7	9
Total Rs.				50,60,231	5	11

FOR THE CULTIVATION OF SCIENCE

as at 31st March, 1957.—(Contd.)

ASSETS	Rs.	As.	P.	Rs.	As.	P.
Brought Forward				50,60,231	5	11
Total Rs.				50,60,231	5	11

We have audited the Balance Sheet of the Indian Association for the Cultivation of Science as at 31st March, 1957, as above set forth and also the annexed Income & Expenditure Account, Statement of Receipts & Payments (General) and the Statement of Receipts & Payments of Sepcial Funds for the year ended on that date with the Books of Accounts produced. Subject to our separate Report of even date addressed to the Members, we are of opinion that the Balance Sheet, the Income & Expenditure Account, the Statement of Receipts and Payments (General) and the Statement of Receipts & Payments of Special Funds are in agreement with the said books of accounts and the Balance Sheet exhibits a true and correct view of the state of affairs of the Association as on that date according to the best of our information and explanations given to us and as shown by the Books of the Association.

The 6th August, 1957.
6, Hastings Street,
CALCUTTA,

G. BASU & CO.,
CHARTERED ACCOUNTANTS
Auditors

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

Annexures to Balance Sheet.

SCHEDULE "A"

Fixed Assets as at 31st March, 1957

(*Other than Laboratory Fittings and Scientific Instruments*).

	Rs. As. P.	Rs. As. P.
Land Acquisition, at cost		
Brought forward	6,17,484 7 9	
Additions during this year	42,462 15 6	
		6,59,947 7 3
Land Development & Road Construction		
Amount transferred from Construction A/c.	31,161 6 0	
Additions during the year	18,851 2 0	
		50,012 8 0
Buildings		
Amount transferred from Construction A/c.	12,22,204 2 8	
Amount transferred from Sanitary & Gas Fittings Account	630 0 0	
Additions during the year	37,362 1 9	
		12,60,196 4 5
Workshop Buildings		
Amount transferred from Construction A/c.	1,07,198 12 6	
Additions during the year	57,444 13 3	
		1,64,643 9 9
Residential Quarters		
Amount transferred from Construction A/c.	17,332 3 3	
Additions during the year	14,708 4 9	
		32,040 8 0
Electric Installation		
Amount transferred from Construction A/c.	1,38,487 5 9	
Amount transferred from Electric Fittings & Equipment A/c.	3,852 11 6	
Additions during the year	5,673 9 6	
		1,48,013 10 9
Laboratory Fittings & Furniture		
Amount transferred from Construction A/c.	1,21,310 0 6	
Additions during the year	1,935 4 9	
		1,23,245 5 3
Carried Over ...		24,38,099 5 5

SCHEDULE "A"—*Contd.*

	Rs. As. P.	Rs. As. P.
Brought Forward ...		24,38,099 5 5
Plant & Machinery		
Amount transferred from Construction A/c.	...	65,811 0 0
Workshop Machines & Equipments		
Brought forward	1,09,869 5 0	
Additions during the year	33,690 6 6	
		1,43,559 11 6
Library		
Brought forward	1,69,633 6 0	
Additions during the year	22,914 12 0	
	1,92,548 2 0	
Less Cost of Lost Books Recovered ...	17 0 0	
		1,92,531 2 0
Furniture & Fittings		
Brought forward	58,040 8 0	
Additions during the year	7,748 15 9	
		65,789 7 9
Lifts		
Amount transferred from Construction A/c.	...	29,853 10 0
Tube Well		
Amount transferred from Construction A/c.	... ...	4,442 0 0
Air-Conditioning Equipment		
Brought forward	13,364 4 6	
Additions during the year	8,169 11 6	
		21,534 0 0
Public Speaking Arrangement		
Brought forward	... ...	2,563 13 0
Motor Van		
Amount transferred from Construction A/c.	...	9,707 0 0
Tools & Implements		
Brought forward	...	891 0 0
Cycles (Vehicles)		
Brought forward	118 0 0	
Additions during the year	260 2 0	
		378 2 0
	Total Rs.	29,75,160 3 8

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

SCHEDULE "B"

	Rs. As. P.	Rs. As. P.
Scientific Instruments & Laboratory Fittings as at 31st March, 1957:—		
(a) *General Physics & X-rays Department*		
Brought forward	1,88,665 1 6	
Additions during the year ...	54,468 15 6	
		2,43,134 1 0
(b) *Magnetism Department,* at cost ...	...	26,062 11 3
(c) *Optics Department*		
Brought forward	66,530 0 0	
Additions during the year ...	7,045 0 0	
		73,575 0 0
(d) *Physical Chemistry Department*		
Brought forward	61,914 0 0	
Additions during the year ...	8,822 11 6	
		70,736 11 6
(e) *Organic Chemistry Department (General)*		
Brought forward	49,356 3 3	
Additions during the year ...	8,583 13 0	
		57,940 0 3
(f) *Organic Chemistry Department (High Polymer)*		
At cost	...	4,604 4 3
(g) *Theoretical Physics Department*		
Brought forward	28,604 0 0	
Additions during the year ...	7,330 0 6	
		35,934 0 6
(h) *Botany Department*		
Brought forward	...	150 0 0
(i) *Inorganic Chemistry Department*		
Brought forward	58,230 0 0	
Additions during the year ...	4,686 9 3	
		62,916 9 3
(j) *Central Scientific Service Department*		
Brought forward	602 7 0	
Additions during the year ...	2,698 6 6	
		3,300 13 6
	Total Rs.	5,78,354 3 6

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

SCHEDULE "C".

Schedule of Depreciation on Fixed Assets other than Scientific Instruments and Laboratory Fittings.

		Rs.	A.	P.
1.	Land Development and Road Construction	622	6	0
1A.	Building	24,433	5	8
2.	Workshop Building	2,142	12	6
3.	Residential Quarters	347	3	3
4.	Electric Installation	7,116	15	9
5.	Laboratory Fittings & Furniture	12,131	0	6
6.	Plant & Machinery	6,581	0	0
7.	Workshop—Machines & Equipments	5,493	7	0
8.	Library	3,392	7	0
9.	Furniture, Fixtures & Fitting	5,804	1	0
10.	Lift	1,403	10	0
11.	Tubewell	222	0	0
12.	Air Conditioning Equipment	668	3	0
13.	Public Speaking Arrangement	128	3	0
14.	Motor Car	1,942	0	0
15.	Tools & Implements	44	9	0
16.	Cycles (Vehicles)	11	13	0
17.	Sanitary & Gas Fittings	31	8	0
	TOTAL Rs.	72,516	8	8

SCHEDULE "D"

Schedule of Depreciation on Scientific Instruments and Laboratory Fittings.

	Rs.	A.	P.
General Physics and X'Ray Department	9,433	4	0
Optics Department	3,326	8	0
Physical Chemistry Department	3,095	8	0
Organic Chemistry Department	2,467	13	0
Theoretical Physics	1,430	3	0
Inorganic Chemistry	2,911	8	0
Central Scientific Services	30	2	0
TOTAL Rs.	22,694	14	0

INDIAN ASSOCIATION

Statement of Receipts and Payments Account

RECEIPTS	Rs.	As.	P.	Rs.	As.	P.
To *Opening Balances*:						
Imprest Cash	1,200	0	0			
In Hand including Cheques ...	46,751	2	6			
At State Bank of India on Current Account, Jadavpur	46,638	0	6			
At State Bank of India on Current Account, Head Office	3,65,801	11	4			
At State Bank of India on Current Account, for Life and Institutional Membership Fund	30,130	15	0			
At State Bank of India on Current Account for Building Maintenance Fund	76,399	14	0			
Government of India:				5,66,921	11	4
Grant-in-Aid (Recurring)	5,97,870	0	0			
Contribution towards Dearness Allowance	30,130	0	0			
Grant-in-Aid (Development Scheme)	40,308	12	0			
Grant-in-Aid (Non-Recurring and Equipment)	3,60,000	0	0			
National Research Fellowship ...	6,832	4	0			
				10,35,141	0	0
Government of West Bengal:						
Grant-in-Aid (Non-Recurring) ...				1,36,000	0	0
Miscellaneous:						
Interest on Investments (General Fund)	495	0	0			
Contribution from M.L.S. Professorship Fund	4,480	0	0			
Contribution from V.L.M. Fund ...	3,940	0	0			
Ordinary Membership Subscription ...	1,015	8	0			
Indian Journal of Physics (Net) ...	8,106	2	1			
Miscellaneous	364	12	0			
Sale of Special Monographs & Books	379	0	1			
Sale of Bijnaner Itihas	5,247	6	6			
				24,027	12	8
Council of Scientific and Industrial Research Grants for:						
Construction of Light Scattering Apparatus	6,389	4	0			
Thermodynamic Properties on High Polymer	9,478	10	0			
Thermal Diffusion and Inter-diffusion of Gases	4,257	13	0			
Mutual Solubilization of Oil & Water	4,101	11	0			
Structure of Frozen Organic liquids Crystal at low Temperature ...	4,050	13	6			
Synthetic Studies in diterpenoid resin acids	1,520	0	0			
Absolute Value of Rate constant etc.	11,900	0	0			
				41,698	3	6
Carried Over ...				18,03,788	11	6

FOR THE CULTIVATION OF SCIENCE

for the year ended 31st March, 1957.

PAYMENTS		Rs. As. P.	Rs. As. P.
By *Establishment*:			
Department of General Physics & X-rays ...	30,608 13 0		
Do. New Posts— 5 Year Plan ...	990 0 0	31,598 13 0	
Department of Magnetism	20,600 15 0		
Do. New Posts— 5 Year Plan ...	2,865 0 0	23,465 15 0	
Department of Optics ...	35,510 0 0		
Do. New Posts— 5 Year Plan ...	1,513 0 0	37,023 0 0	
Department of Theoretical Physics	23,914 7 0		
Do. New Posts— 5 Year Plan ...	1,600 0 0	25,514 7 0	
Department of Physical Chemistry ...	34,495 11 0		
Do. Rubber Section— 5 Year Plan ...	7,454 9 0		
Do. General— 5 Year Plan ...	2,370 0 0	44,320 4 0	
Department of Organic Chemistry ...	32,980 6 0		
Do. General— 5 Year Plan ...	2,066 11 0		
Do. Training in High Polymer— 5 Year Plan ...	5,392 15 0	40,440 0 0	
Department of Inorganic Chemistry ...	21,538 4 0		
Do. Analytical Laboratory— 5 Year Plan ...	2,390 9 0	23,928 13 0	
Library		7,855 6 0	
Workshop	22,460 6 0		
Do. New Posts— 5 Year Plan ...	2,132 9 0	24,592 15 0	
Administration ...	46,925 8 0		
Do. New Posts— 5 Year Plan ...	2,121 12 0	49,047 4 0	
Carried Over		3,07,786 13 0	

INDIAN ASSOCIATION

Statement of Receipts and Payments Account

RECEIPTS.	Rs.	As.	P.	Rs.	As.	P.
Brought Forward ...				18,03,788	11	6
Indian Lac Cess Committee Grants ...	...			3,400	0	0
Provident Fund Subscription & Recovery of Advance etc.	...			17,283	5	0
C. S. I. R. Employees Provident Fund:						
Amount collected	717	0	0			
Less Amount disbursed	706	0	0			
				11	0	0
I. C. A. R. Employees Provident Fund ...	...			103	2	0
Advance & Suspense	...			69,914	7	3
To *Library Deposits*:						
Deposits Received	75	0	0			
Less: Deposits Refunded	25	0	0			
				50	0	0
Library:						
Amount Realised	...			17	0	0
Dr. M. N. Saha Memorial Fund ...	...			14,879	0	0
General Fund:						
Being adjustment on account of cheques issued in the previous year	...			452	14	0
Carried Over				19,09,899	7	9

FOR THE CULTIVATION OF SCIENCE

for the year ended 31st March, 1957.—(Contd.)

PAYMENTS.			Rs.	As.	P.	Rs.	As.	P.
Brought Forward ...			3,07,786	13	0			
Directors' Office ...	...		24,538	7	0			
Central Scientific Services	...		741	0	0			
Indian Journal of Physics	...		5,352	9	0			
Publication ...	...		2,850	0	0			
						3,41,268	13	0
Contribution to Provident Fund	...		...			14,813	5	0
P. F. Subscription & Advances etc.	...		...			17,175	13	0
Laboratory Grants:								
General Physics & X-ray (Recurring):								
Laboratory Charges	3,588	3 6						
Scientific Instrument	5,781	12 3	9,369	15	9			
General Physics & X-ray (Special Revoted):								
Scientific Instruments ...	...		1,990	2	9			
General Physics & X-rays (Revoted):								
Laboratory charges	1,998	5 9						
Scientific Instruments	2,367	9 0	4,365	14	9			
Magnetism (Recurring):								
Laboratory charges	1,957	8 9						
Scientific Instruments	5,772	10 9	7,730	3	6			
Optics (Recurring):								
Laboratory charges	4,117	0 0						
Scientific Instruments	3,475	2 0	7,592	2	0			
Theoretical Physics (Recurring):								
Laboratory charges	396	13 3						
Scientific Instruments	652	6 6	1,049	3	9			
Theoretical Physics (Revoted):								
Scientific Instruments ...	...		200	2	6			
Physical Chemistry (Recurring):								
Laboratory charges	4,704	1 3						
Scientific Instruments	3,221	6 3	7,925	7	6			
Physical Chemistry (Revoted):								
Scientific Instruments ...	...		690	3	0			
Organic Chemistry (Recurring):								
Laboratory charges	17,645	12 9						
Scientific Instruments	429	3 6	18,075	0	3			
Carried Over ...			58,988	7	9	3,73,257	15	0

INDIAN ASSOCIATION

Statement of Receipts and Payments Account

RECEIPTS	Rs.	As.	P.	Rs.	As.	P.
Brought Forward				19,09,899	7	9
Carried Over ...				19,09,899	7	9

FOR THE CULTIVATION OF SCIENCE

for the year ended 31st March, 1957.—(Contd.)

PAYMENTS.	Rs. As. P.	Rs. As. P.
Brought Forward ...	58,988 7 9	3,73,257 15 0
Organic Chemistry (Special Revoted):		
Scientific Instruments	199 12 9	
Inorganic Chemistry (Recurring):		
Laboratory charges 7,907 10 9		
Scientific Instruments 1,596 9 0	9,504 3 9	
Inorganic Chemistry (Revoted):		
Laboratory charges 583 12 0		
Scientific Instruments 485 13 0	1,069 9 0	
Central Scientific Services (Recurring):		
Scientific Instruments	2,160 8 6	
		71,922 9 9
Laboratory Grants—Govt. of India (Non-Recurring:		
General Physics & X-rays—		
Equipments ... 35,456 9 0		
Charges ... 350 12 0	35,807 5 0	
Magnetism-Instruments	20,290 0 6	
Optics—Instruments 3,569 14 0		
Charges 37 6 3	3,607 4 3	
Theoretical Physics—Equipments ...	6,477 7 6	
Physical Chemistry—Equipments ...	4,911 2 3	
Organic Chemistry—		
Equipments ... 7,200 12 9		
Charges ... 1,914 5 9	9,115 2 6	
Organic Chemistry—High Polymer—		
Instruments ... 4,604 4 3		
Charges ... 55 7 9	4,659 12 0	
Inorganic Chemistry—Equipments ...	279 4 3	
Workshop Machines	29,502 13 6	
Furniture	1,160 15 9	
Air Conditioning Equipments ...	8,169 11 6	
Exhaust Fans for Laboratories ...	245 12 0	
		1,24,226 11 0
Carried Over ...		5,69,407 3 9

INDIAN ASSOCIATION

Statement of Receipts and Payments Account

RECEIPTS	Rs.	As.	P.	Rs.	As.	P.
Brought Forward				19,09,899	7	9
Carried Over ...				19,09,899	7	9

FOR THE CULTIVATION OF SCIENCE

for the year ended 31st March, 1957.—(Contd.)

PAYMENTS				Rs.	As.	P.	Rs.	As.	P.
Brought Forward ...							5,69,407	3	9
Laboratory Grants—Government of West Bengal:									
General Physics & X-rays—Instruments				8,872	14	6			
Organic Chemistry—									
Instruments ...	754	0	0						
Charges ...	282	0	9	1,036	0	9			
Inorganic Chemistry—									
Instruments ...	2,324	15	0						
Charges ...	129	3	0	2,454	2	0			
Central Scientific Services—Instruments				537	14	0			
Workshop Machines				305	1	0			
Tube-well & Pump House				5,775	14	0			
Construction of Roads, etc. ...				318	6	0			
							19,300	4	3
Library Grants (Recurring):									
Books & Journals	22,868	5	6						
Up-keep ...	1,710	1	0	24,578	6	6			
Library Grant (Revoted):									
Books & Journals	46	6	6						
Up-keep ...	171	0	0	217	6	6			
							24,795	13	0
Workshop Grant (Recurring):									
Workshop Charges	2,362	12	3						
Instruments ...	3,882	8	0	6,245	4	3			
Workshop Grant (Revoted):									
Workshop charges				284	9	6			
							6,529	13	9
Indian Journal of Physics:									
Publication Expenses				17,495	8	0			
Do. Revoted				240	3	3			
							17,735	11	3
Miscellaneous:									
Electric Fittings				3,400	11	6			
Do. (Revoted)				2,027	2	0			
Do. (Consumable)				2,016	8	0			
Gas Charges				3,383	9	0			
Electric charges				8,980	14	6			
Telephone				1,837	11	0			
Printing				974	0	0			
Do. Revoted				297	0	0			
Stationery & Contingencies ...				6,873	14	9			
Postage				4,074	14	6			
Advertisement				5,016	12	0			
Municipal Taxes				1,622	11	0			
Travelling Allowance for attending meetings etc.				6,321	0	6			
Bank Charges				129	15	4			
Carried Over ...				46,956	12	1	6,37,768	14	0

INDIAN ASSOCIATION

Statement of Receipts and Payments Account

RECEIPTS	Rs.	As.	P.	Rs.	As.	P.
Brought Forward				19,09,899	7	9
Carried Over				19,09,899	7	9

FOR THE CULTIVATION OF SCIENCE

for the year ended 31st March, 1957.—(Contd.)

PAYMENTS	Rs.	As.	P.	Rs.	As.	P.
Brought Forward ...	...			10,44,869	3	4
Council of Scientific & Industrial Research						
Crystal Structure of Frozen Organic etc.:						
Staff ...	3,060	0	0			
Contingencies ...	744	2	0	3,804	2	0
Light Scattering:						
Staff ...	5,669	14	0			
Contingencies ...	976	4	9	6,646	2	9
Thermodynamic Properties:						
Staff ...	7,863	11	0			
Contingencies ...	898	5	0	8,762	0	0
Thermal Diffusion:						
Staff ...	3,068	1	0			
Contingencies ...	1,549	4	0	4,617	5	0
Mutual Solubilization:						
Staff ...	2,690	0	0			
Contingencies ...	540	0	0	3,230	0	0
Synthetic Studies in deterpenoid etc.:						
Staff ...	2,605	13	0			
Contingencies ...	999	7	9	3,605	4	9
Absolute Values of Rate Constant etc.:						
Staff ...	178	9	0			
Contingencies ...	100	5	3	278	14	3
				30,943	12	9
Development of Research Training Facilities:						
General Physics & X-rays				9,088	0	0
Optics				3,985	9	0
Physical Chemistry				3,201	1	0
Organic Chemistry				9,600	0	0
Inorganic Chemistry				4,800	0	0
Theoretical Physics				2,314	8	0
				32,989	2	0
National Research Fellowship:						
Scholarship				4,800	0	0
Contingencies				965	9	0
				5,765	9	0
I. C. A. R. Synthetic Polyelectrolytes:						
Staff				2,250	0	0
I. L. C. C. Styrenation of Shellac:						
Fellowship				2,200	0	0
Contingencies				316	8	3
				2,516	8	3
Carried Over ...				11,19,334	3	4

INDIAN ASSOCIATION

Statement of Receipts and Payments Account

RECEIPTS	Rs.	As.	P.	Rs.	As.	P.
Brought Forward ...				19,09,899	7	9
Carried Over ...				19,09,899	7	9

CALCUTTA,
6, Hastings Street,
The 6th August, 1957.

FOR THE CULTIVATION OF SCIENCE

for the year ended 31st March, 1957.—(Concld.)

PAYMENTS	Rs.	As.	P.	Rs.	As.	P.
Brought Forward ...				11,19,334	3	4
Repayment of Loan to Govt. of India ...	...			6,500	0	0
Telephone Rent Suspense	...			247	8	0
Closing Balances:						
Imprest Cash	1,300	0	0			
In Hand including cheques ...	1,79,931	6	0			
At State Bank of India on Current Account—Jadavpur	76,498	1	6			
At State Bank of India on Current Account H. O.	3,44,197	7	11			
At State Bank of India on Current Account for Life & Institutional Membership Fund	30,130	15	0			
At State Bank of India on Current Account for Building Maintenance Fund	1,21,759	14	0			
At State Bank of India on Current Account for Depreciation Fund ...	30,000	0	0			
				7,83,817	12	5
...				19,09,899	7	9

In terms of our Report of even date

G. Basu & Co.,
Chartered Accountants
Auditors.

INDIAN ASSOCIATION

Income and Expenditure Account for

EXPENDITURE	Rs.	As.	P.	Rs.	As.	P.
To *Establishment*—General						
Department of General Physics & X-Rays ...	30,753	15	0			
„ „ Magnetism	20,600	15	0			
„ „ Optics	35,510	0	0			
„ „ Theoretical Physics ...	25,514	7	0			
„ „ Physical Chemistry ...	34,495	11	0			
„ „ Organic Chemistry ...	32,980	6	0			
„ „ Inorganic Chemistry	21,538	4	0			
Library	7,855	6	0			
Workshop	22,460	6	0			
Indian Journal of Physics	5,352	9	0			
Administration	46,925	8	0			
Publication Department	2,850	0	0			
Director and his Staff	24,538	7	0			
Central Scientific Services	741	0	0			
				3,12,116	14	0
Establishment—New Post (5 Year Plan)						
Department of General Physics & X-Rays ...	990	0	0			
„ „ Magnetism ...	2,865	0	0			
„ „ Optics	1,513	0	0			
„ „ Physical Chemistry ...	2,370	0	0			
„ „ do. Rubber Section	7,454	9	0			
„ „ Organic Chemistry—High Palymer ...	5,392	15	0			
„ „ Inorganic Chemistry—Analytical Laboratory	2,390	9	0			
„ „ Workshop ...	2,132	9	0			
Administration	2,121	12	0			
National Research Fellowship (Organic Chemistry)	2,066	11	0			
				29,297	1	0
Laboratory Grants—						
General Physics and X-Rays						
Recurring Charges	3,588	3	6			
Recurring (Revoted) Charges ...	1,998	5	9			
Government of India Grant (Non-Recurring) Charges	350	12	0			
				5,937	5	3
Optics						
Recurring Charges	4,117	0	0			
Government of India Grant (Non-Recurring) Charges	37	6	3			
				4,154	6	3
Theoretical Physics						
Recurring Charges	...			396	13	3
Physical Chemistry	...			4,704	1	3
Carried Over ...				3,56,606	9	0

FOR THE CULTIVATION OF SCIENCE

the year ended 31st March, 1957.

INCOME	Rs.	As.	P.	Rs.	As.	P.
By *Government of India*—						
Grant-in-Aid (Recurring) ...	5,97,870	0	0			
Contribution towards Dearness Allowance	30,130	0	0			
Government of India Grant-in-Aid for Development	40,308	12	0			
				6,68,308	12	0
Government of West Bengal—						
Grant-in-Aid (Recurring)				56,000	0	0
Miscellaneous—						
Ordinary Membership Subscription ...	1,015	8	0			
Journal Subscription	8,106	2	1			
Miscellaneous	364	12	0			
Sale of Special Monograph & Book ...	379	0	1			
Interest	495	0	0			
				10,360	6	2
Contribution from M.L.S. Prof. Fund	...			4,480	0	0
Contribution from V.L.M. Prof. Fund	...			3,940	0	0
Carried Over ...				7,43,089	2	2

INDIAN ASSOCIATION

Income and Expenditure Account for

EXPENDITURE	Rs.	As.	P.	Rs.	As.	P.
Brought Forward ...				3,56,606	9	0
Organic Chemistry						
Recurring Charges	17,645	12	9			
Government of India Grant (Non-Recurring) High Palymer Charges	55	7	9			
Government of India Grant (Non-Recurring) Charges	1,914	5	9			
Government of West Bengal (Non-Recurring) Charges	282	0	9			
				19,897	11	0
Inorganic Chemistry						
Recurring Charges	7,907	10	9			
Recurring (Revoted) Charges ...	583	12	0			
Government of West Bengal Grant (Non-Recurring) Charges ...	129	3	0			
				8,620	9	9
Magnetism						
Recurring Charges	...			1,957	8	9
Library Grant						
Recurring—Upkeep	1,710	1	0			
Recurring (Revoted) Charges ...	171	0	0			
				1,881	1	0
Workshop Grant						
Recurring Charges	2,362	12	3			
Recurring (Revoted) Charges ...	284	9	6			
				2,647	5	9
Miscellaneous—						
Electric Charges	8,980	14	6			
Gas Charges	3,383	9	0			
Telephone Charges	1,837	11	0			
Postage	4,074	14	6			
Bank Charges	129	15	4			
Stationery & Contingency ...	6,873	14	9			
Printing 974 0 0						
Do. (Revoted) ... 297 0 0	1,271	0	0			
Advertisement	5,016	12	0			
Motor Van Upkeep	3,323	4	0			
Municipal Tax	1,622	11	0			
Audit Fees	250	0	0			
Indian Journal of Physics Publication Expenses 17,495 8 0						
Do. (Revoted) 240 3 3	17,735	11	3			
Meeting Expenses	701	7	6			
Insurance	1,046	4	0			
Carried Over ...	56,248	0	10	3,91,610	13	3

FOR THE CULTIVATION OF SCIENCE

for the year ended 31st March, 1957.—(Contd.)

INCOME	Rs.	As.	P.	Rs.	As.	P.
Brought Forward ...				7,43,089	2	2
Carried Over ...				7,43,089	2	2

INDIAN ASSOCIATION

Income and Expenditure Account for

EXPENDITURE	Rs.	As.	P.	Rs.	As.	P.
Brought Forward ...	56,248	0	10	3,91,610	13	3
Contribution to Indian Science News Association	1,000	0	0			
Indian Science Congress Subscription	12	0	0			
Travelling Allowance for attending meetings etc.	6,321	0	6			
Provision for Higher Salaries ...	517	12	0			
Provision for Research Staff T.A. ...	1,570	0	0			
Contribution to Association Canteen	600	0	0			
Miscellaneous	4,523	8	9			
Electrical Fittings (Consumable) ...	2,016	8	0			
Laboratory Fittings (Consumable) ...	299	10	6			
				73,108	8	7
Development of Research Training Facilities						
General Physics & X-Rays ...	9,088	0	0			
Optics	3,985	9	0			
Theoretical Physics	2,314	8	0			
Physical Chemistry	3,201	1	0			
Organic Chemistry	9,600	0	0			
Inorganic Chemistry	4,800	0	0			
				32,989	2	0
Interest—						
On Government of India Loan ...	...			3,500	0	0
Publiction—General	3,375	9	3			
Do. (Revoted)	147	8	6			
				3,523	1	9
Provident Fund Contribution ...	...			14,813	5	0
Depreciation—						
As per Schedule "C"	72,516	8	8			
As per Schedule "D"	22,694	14	0			
				95,211	6	8
Excess of Income over Expenditure transferred to Fund	...			1,28,332	12	11
Total Rs.				7,43,089	2	2

Calcutta,
6, Hastings Street,
The 6th August, 1957.

FOR THE CULTIVATION OF SCIENCE

the year ended 31st March, 1957.—(Contd.)

INCOME	Rs.	As.	P.	Rs.	As.	P.
Brought Forward ...	...			7,43,089	2	2

Total Rs. 7,43,089 2 2

G. Basu & Co.,
Chartered Accountants
Auditors.

INDIAN ASSOCIATION

SPECIAL

Statement of Receipts and Payments

RECEIPTS	Rs.	As.	P.	Rs.	As.	P.
Opening Balance as on 1st April, 1956						
With State Bank of India on Current Account for						
Research Endowment Fund	15,721	15	3			
Woodburn Medal Fund	470	9	0			
Victoria Prof. Fund	525	8	3			
Library Reserve Fund	1,859	7	0			
Building Fund	3,989	0	10			
Dr. Bimala Charan Law Gold Medal Fund	730	2	7			
Hare Prof. Fund	535	12	0			
Nikunja Garabini Prize Fund	351	2	2			
Vehari Lal Mitra Fund	12,059	7	10			
Dr. Sarkar Research Medal Fund ...	1,922	12	3			
Jaikishan Mukherjee Gold Medal Fund	2,234	9	8			
Mahendra Lal Sarcar Prof. Fund ...	6,343	9	11			
Jatindra Chandra Prize Fund	338	5	0			
Ripon Prof. Fund	8,255	3	9			
Cooch-Behar Prof. Fund	7,112	6	7			
				62,450	0	1
Woodburn Medal Fund						
Interest	...			45	0	0
Victoria Prof. Fund						
Interest	...			45	0	0
Building Fund						
Interest	...			285	0	0
Dr. Bimala Charan Law Gold Medal Fund						
Interest	...			210	0	0
Hare Prof. Fund						
Interest	...			45	0	0
Nikunja Garabini Prize Fund						
Interest	...			30	0	0
Veharilal Mitra Fund						
Interest	...			3,960	0	0
Dr. Sarkar Research Fund						
Interest	...			150	0	0
Jaikishan Mukherjee Gold Medal Fund						
Interest	402	0	0			
Special Publication	11	7	6			
				413	7	6
Carried Over ...	...			67,633	7	7

FOR THE CULTIVATION OF SCIENCE FUNDS

for the year ended 31st March, 1957.

PAYMENTS	Rs.	As.	P.	Rs.	As.	P.
Research Endowment Fund						
Bank Charges				0	1	0
Woodburn Medal Fund						
Bank Charges				0	9	0
Victoria Prof. Fund						
Bank Charges				0	9	0
Library Reserve Fund						
Bank Charges				0	1	0
Building Fund						
Bank Charges				0	13	0
Dr. Bimala Charan Law Gold Medal Fund						
Bank Charges	1	1	0			
Income-tax	15	12	0			
Renewal Fees	2	0	0			
				18	13	0
Hare Prof. Fund						
Bank Charges				0	9	0
Nikunja Garabini Prize Fund						
Bank Charges				0	9	0
Vehari Lal Mitra Fund						
Bank Charges	10	11	0			
Salary of M.L.S. Professors transferred to General Fund	3,940	0	0			
				3,950	11	0
Dr. Sarkar Research Medal Fund						
Bank Charges				0	9	0
Jaikishan Mukherjee Gold Medal Fund						
Bank Charges	1	7	0			
Cost of Medal	775	7	6			
				776	14	6
Mohendra Lal Sarkar Prof. Fund						
Bank Charges	12	1	0			
Salary of M.L.S. Professors transferred to General Fund	4,480	0	0			
				4,492	1	0
Jatindra Chandra Prize Fund						
Bank Charges				0	9	0
Ripon Professors Fund						
Bank Charges	6	10	0			
Honorarium	750	0	0			
				756	10	0
Cooch-Behar Professors Fund						
Bank Charges				3	3	0
Carried Over ...				10,002	9	6

INDIAN ASSOCIATION

SPECIAL

Statement of Receipts and Payments

RECEIPTS	Rs.	As.	P.	Rs.	As.	P.
Brought Forward ...	...			67,633	7	7
Mahendra Lal Sarkar Prof. Fund						
Interest	...			4,485	0	0
Jatindra Chandra Prize Fund						
Interest	...			30	0	0
Ripon Prof Fund						
Interest	750	0	0			
Special Publication Sale	487	11	1			
				1,237	11	1
Cooch-Behar Prof. Fund						
Interest	990	0	0			
Special Publication Sale	49	5	3			
				1,039	5	3
Total Rs.				74,425	7	11

Calcutta,
6, Hastings Street,
The 6th August, 1957.

FOR THE CULTIVATION OF SCIENCE FUNDS

for the year ended 31st March, 1957.—(Contd.)

PAYMENTS	Rs.	As.	P.	Rs.	As.	P.
Brought Forward ...	...			10,002	9	6
Closing Balances						
With the State Bank of India for ...						
Research Endowment Fund	15,721	14	3			
Woodburn Medal Fund	515	0	0			
Victoria Professors Fund	569	15	3			
Library Reserve Fund	1,859	6	0			
Building Fund	4,273	3	10			
Dr. Bimala Charan Law Gold Medal Fund	921	5	7			
Hare Professors Fund	580	3	0			
Nikunja Garabini Prize Fund	380	9	2			
Vehari Lal Mitra Fund	12,068	12	10			
Dr. Sarkar Research Fund	2,072	3	3			
Jaikishan Mukherjee Gold Medal Fund	1,871	2	8			
Mohendra Lal Sarkar Professors Fund ...	6,336	8	11			
Jatindra Chandra Prize Fund ...	367	12	0			
Ripon Professors Fund	8,736	4	10			
Cooch-Behar Professors Fund ...	8,148	8	10			
				64,422	14	5
Total Rs.				74,425	7	11

In term of our report of even date.

G. Basu & Co.,
Chartered Accountants
Auditors.

SCIENCE ASSOCIATION EMPLOYEES PROVIDENT FUND ACCOUNT

1956-57

Balance Sheet as at 31st March, 1957.

ABSTRACT

LIABILITIES.	Rs.	As.	P.	ASSETS.	Rs.	As.	P.
Members' Subscriptions and Association's Contributions	1,57,615	9	5	Loans to Members	6,869	8	0
Indian Association for the Cultivation of Science A/c. General Fund:— (amount not withdrawn)	1,289	6	0	Indian Association for the Cultivation of Science A/c. General Fund:— (amount to be deposited)	109	12	0
Amount due to Ex-members	17,383	2	8	*Investment*— 3% G. P. Notes of face value Rs. 5,000/- (lodged with State Bank of India) ...	4,978	12	0
				National Savings Certificates purchased on different dates (lodged with State Bank of India) for Rs. 23,000/-, 10,000/-, 24,000/- and 37,000/-	94,000	0	0
				Interest accrued on National Savings Certificates upto 31-3-57	15,759	0	0
				Fixed Deposit A/c.	25,000	0	0
				Balance with State Bank of India— Savings A/c. No. 36456	29,571	2	1
TOTAL Rs. ...	1,76,288	2	1	TOTAL Rs. ...	1,76,288	2	1

STATEMENT SHOWING THE BREAK-DOWN OF CONSTRUCTION EXPENDITURES FOR THE YEAR ENDED 31-3-57

	ITEMS	As on March 31, 1956	Addition during 1956-57	As on March 31, 1957	REMARKS
A.	Construction Expenditure:—				
1.	(*a*) Main Research Building ground floor, Assembly Hall, Library, and Central Tower	7,71,433 15 6	—	7,71,433 15 6	
	(*b*) Main Research Building First Floor	—	28,644 13 0	28,644 13 0	
2.	Workshop	91,228 6 6	56,909 11 3	1,48,138 1 9	
3.	Cryogenic Laboratory	11,792 0 0	—	11,792 0 0	
4.	Transformer House	12,500 0 0	—	12,500 0 0	
5.	Pump and Filter House	4,000 0 0	—	4,000 0 0	
6.	Gate Keeper's Lodge	20,000 0 0	—	20,000 0 0	
7.	Culverts and Compound Wall	6,095 2 0	—	6,095 2 0	
8.	Roads, Surface drains, earth filling and general development ...	29,321 6 0	18,851 2 0	48,172 8 0	
9.	Remuneration to Messrs. Martin Burn and labour for above work @ 12½% profit	2,43,898 9 0	—	2,43,898 9 0	
10.	Sweepers Quarters (departmentally done)	5,000 0 0	—	5,000 0 0	
11.	Store Room	6,544 0 0	—	6,544 0 0	
12.	Fencing and Fixing	22,823 1 6	—	22,823 1 6	
13.	Electrical Fittings, installations, cable laying, etc.	1,30,285 5 9	—	1,30,285 5 9	
14.	Transformer, Rectifier, etc.	47,644 0 0	—	47,644 0 0	
	Do. Erection	4,590 0 0	—	4,590 0 0	
15.	Sanitary and Gas Fittings	71,177 2 2	—	71,177 2 2	
16.	Tube Well	4,177 0 0	6,483 11 9	10,660 11 9	
17.	Water Softner Plant	10,925 0 0	—	10,925 0 0	
18.	Laboratory Fittings and Furniture	1,16,626 0 6	1,751 11 9	1,18,377 12 3	
19.	Electric Passenger Lift	28,063 10 0	—	28,063 10 0	
20.	Vehicle	9,330 0 0	—	9,330 0 0	
	Do. Petrol	1,966 0 0	—	1,966 0 0	
21.	Messrs. Chaudhuri & Guha's remuneration	27,900 0 0	—	27,900 0 0	
22.	Establishment	26,254 0 0	—	26,254 0 0	
23.	Miscellaneous	30,713 3 3	—	30,713 3 3	
24.	Residential Quarter	16,310 0 0	14,708 4 9	31,018 4 9	
25.	Air Conditioning Compressor Room	524 13 0	—	524 13 0	
26.	Chemical Stores	—	406 0 0	406 0 0	
27.	Garage		1,597 4 0	1,597 4 0	
		17,51,122 11 2	1,29,352 10 6	18,80,475 5 8*	* Less adjustment Rs. 1,649-2-6
B.	Land Acquisition	6,17,484 7 9	42,462 15 6	6,59,947 7 3	
C.	Security Deposit with Calcutta Electric Supply Corporation Ltd. ...	1,800 0 0	—	1,800 0 0	
		23,70,407 2 11	1,71,815 10 0	25,42,222 12 11	

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