

W. S. Man

16 FEB 1952

Rec

THE INDIAN ASSOCIATION FOR THE
CULTIVATION OF SCIENCE

ANNUAL REPORT FOR 1950-51

COUNCIL FOR 1950-51
THE INDIAN ASSOCIATION FOR THE
CULTIVATION OF SCIENCE

President :

Prof. M. N. Saha, D.Sc., F.R.S., F.N.I.

Vice-Presidents :

Dr. I. G. Ghosh, D.Sc., F.N.I.

Dr. D. N. Mahapatra, Ph.D.

Honorary Director :

Prof. P. K. Ray, M.A., F.R.S., F.N.I.

Members :

Dr. P. K. Ray, M.A., F.R.S., F.N.I.

Dr. P. K. Ray, D.Sc.

Dr. P. C. Gupta, D.Sc.

Dr. S. C. Chandra, D.Sc., F.N.I.

Dr. S. C. Chandra, M.A., B.L.

ANNUAL REPORT FOR 1950-51

Prof. S. K. Roy, M.A., F.R.S., F.N.I.

Dr. P. K. Ray, M.A., F.R.S., F.N.I.

Trustee-Member :

The Hon'ble Justice Mr. K. P. Mukherjee, M.A., B.L.

Secretary of National Institute of Science of India :

Prof. B. B. De, D.Sc.

Prof. D. S. Kothari, D.Sc., F.N.I.

Members of the Government of India :

Secretary, Department of Scientific Research (for his nominee)

Educational Adviser to the Government of India (for his nominee)

Dr. M. S. Bhattacharya, Joint Secretary, Ministry of Finance, Govt. of India

Members of the Government of West Bengal :

Dr. D. M. Sen, M.A., Ph.D.

Jadavpur, Calcutta-32

Prof. S. K. Roy

COUNCIL FOR 1950-51

(As constituted, in accordance with the new Regulations, on July 25, 1950)

President :

Prof. M. N. Saha, D.Sc., F.R.S., F.N.I.

Vice-Presidents :

Dr. J. C. Ghosh, D.Sc., F.N.I.

Dr. D. M. Bose, M.A., Ph.D.

Hony. Director :

Prof. P. Ray, M.A., F.I.A.S., F.N.I.

Members :

Sri Dwijesh Chandra Chakrabarti, M.Sc.

Dr. S. R. Bose, D.Sc.

Dr. B. C. Guha, D.Sc.

Dr. Satis Chandra Ganguly, M.Sc., D.Phil.

Hon'ble Sri C. C. Biswas, C.I.E., M.A., B.L.

Dr. S. K. Banerji, D.Sc.

Prof. S. K. Mitra, M.B.E., D.Sc.

Prof. P. C. Mahanti, D.Sc.

Prof. S. K. Roy, M.E.E., M.A.I.E., M.I.E.

Dr. P. N. Brahmachari, M.Sc., M.D., P.R.S.

Trustee-Member :

The Hon'ble Justice Mr. R. P. Mookerjee, M.A., B.L.

Nominees of National Institute of Sciences of India :

Prof. B. B. De, D.Sc.

Prof. D. S. Kothari, D.Sc., F.N.I.

Nominees of the Government of India :

Secretary, Department of Scientific Research (or his nominee)

Educational Adviser to the Government of India (or his nominee.)

Sri M. S. Bhatnagar, Joint Secretary, Ministry of Finance, Govt. of India.

Nominee of the Government of West Bengal :

Dr. D. M. Sen, M.A., Ph.D.

Professor-Member :

Prof. Santi R. Palit.



New Research Building of the Indian Association for the Cultivation of Science,
JADAVPUR

THE
INDIAN ASSOCIATION
FOR THE
CULTIVATION OF SCIENCE

ANNUAL REPORT FOR 1950-51

I. GENERAL

The New Research Building of the Association

The principal events of the Association during the year under review, were the completion of the Association's new Research Building at Jadavpur and the shifting of the laboratories, library, office and workshop from the old building at 210 Bowbazar Street to the new building at Jadavpur. The Hony. Director reported last year that the construction of the ground floor, the assembly hall and the library hall was nearly completed by March, 1950. Yet the entire work of flooring, the installation of sanitary and gas services, electrical installations, making of laboratory chemical benches and general furniture for library, assembly hall, office and laboratories, development of general lay-out and many minor but important works remained to be finished. All these works were completed by the end of March 1951. Moreover, two separate structures, the workshop and the cryogenic laboratory, were undertaken and completed during the year, each at an estimated cost of Rs. 36,774/- and Rs. 11,792/- respectively.

At the very early stage of the planning and undertaking of the work, it was decided to make bulk purchase of electric power at 450 K.W. at 6000 volts from the Calcutta Electric Supply Corporation. The Association made its own arrangement for installation of transformer, rectifier and switchgear for the supply of 230 volts A.C. & D.C. power.

The Association, through the good offices of Messrs. Oriental Gas Co. Ltd., has been able to secure supply of gas to its laboratories. As in the previous year, the Association received full co-operation of the various Government Controlling Departments and Ministries regarding permits for cement, pipes, fittings etc. The Association express their sincere thanks to these Departments and Ministries for such co-operation. The Post & Telegraphs, Telephones, were very kind to transfer the Association's old line from Bowbazar building and instal an additional line.

Shifting of the Laboratories, Library, Office, Workshop, etc., to the New Research Building

From about the beginning of January, 1951, the Association started shifting its laboratories, library, office and workshop. The library of the Association was the first unit to be packed and shifted to the new building. Part of the Department of Physical Chemistry arrived in January and started functioning by February. Other Research Departments followed suit and by the beginning of March, most of the Departments, including the office, started functioning in the new building.

Disposal of the Association's Old Building at 210 Bowbazar Street

In his report for the year 1949-50, the Hon'y. Director informed that the Association received an enquiry from the Government of West Bengal as to the probable value of the building and that negotiations towards that end were under way. The old premises of the Association at 210 Bowbazar Street were ultimately disposed of and made over to the Government of West Bengal in return of a value of Rs. 7 lakhs. The negotiation was successfully completed through the personal efforts of Prof. M. N. Saha, the President, and Sri N. C. Chunder, one of the Trustees of the Association.

Council Election and Enrolment of Ordinary and Life Members

The annual election of the Ordinary Members of the Council were held during the month of April and May, 1950 and the result announced to the Annual General Meeting held on July 25, 1950. Hon'ble Sri C. C. Biswas, Dr. S. K. Banerjee and Dr. P. N. Brahmachari were elected as Ordinary Members of the Council. Dr. D. M. Bose was elected to the office of the Vice-President. The National Institute of Sciences of India nominated Dr. D. S. Kothari and Prof. B. B. Dey and the Government of India nominated Sri M. S. Bhatnagar, Joint-Secretary, Ministry of Finance, as the financial expert. Prof. Santi R. Palit was appointed Professor-Member of the Council. The list of Office-Bearers, Ordinary Members and Nominees constituting the full Council for 1950-51 is given at the beginning of this report.

During the year under review, death was reported of Sri Charu Chandra Ghosh (d. August 19, 1949), an Ordinary Member of the Association, Rai Jatindra Nath Chowdhury (d. September 30, 1949) and Dr. Panchanan Neogi (d. June 5, 1950), both Life Members of the Association. Sri Charu Chandra Ghosh was the Deputy Director, Sericulture, Government of West Bengal and was well known for good work in this important field of industry. The work of Rai Jatindra Nath Chowdhury, Proprietor of the Maya Engineering Works, was confined not only to industrial enterprises, he was also well known for his many social services. Dr. Panchanan Neogi, a distinguished chemist and educationist, had long and intimate connection with the Association. He was one of those few old members of the Association who had always worked for the advancement of this institution and the Association suffered a great loss through his death.

Four gentlemen were elected Life Members of the Association, of whom three were admitted during the year under review. Ordinary members elected totalled 46, of whom 24 were admitted. During the same period 12 gentlemen ceased to be Ordinary Members for non-payment of subscriptions within the stipulated period.

Meetings of the Council and Committees

Two special General Meetings, one Annual General Meeting, four meetings of the Council, three of the Finance Committee, ten of the Staff Committee and eight meetings of the Construction Committee were held during the year under review. The Selection Committees and Appointing Boards accounted for 10 meetings, and there was one meeting of the B. C. Law Gold Medal Advisory Board.

Research Departments, Appointments Etc.

The Department of X-rays and Magnetism, Optics and Physical Chemistry continued their research activities with full personnel as in the previous year. The Department of Organic Chemistry which came into existence last year with the Reader, the Research Officer and one Senior Research Scholar, was fully established at the beginning of the year. A small laboratory was set up, which started functioning from June and was able to produce good work by the end of the year.

The Association had considerable difficulties in filling the posts of the Department of Theoretical Physics. Dr. Robert Simha, of the National Bureau of Standards, U.S.A., whose appointment as Professor of Theoretical Physics was reported last year, conveyed his inability to accept the appointment. Dr. D. Basu, Ph.D., who had worked in the Dublin Institute for Advanced Studies, Department of Theoretical Physics under Prof. Heitler and other eminent theoretical physicists, was appointed Reader. He joined the Association in July 1950 and started organizing the Department.

During the year under review efforts were made to establish the Department of Inorganic Chemistry. Dr. Pares Chandra Banerjee, Ph.D., was appointed Research Officer to the Department. The workshop staff was strengthened by the appointment of Sri Kalyan Kumar Chatterjee, B.Sc., B.M.E., as Workshop Supervisor.

Research Schemes

C. S. I. R. The Council of Scientific and Industrial Research sanctioned the following schemes: (1) X-ray studies of coal, and (2) High polymers—scheme on Construction of Osmometers. These schemes were continued from the previous year.

Development Scheme for Research Training Facilities under the Scientific Man Power Committee: This scheme was initiated last year by the Department of Scientific Research, as then called, of the Government of India, and a sum

of Rs. 30,000 was received for the purpose. The scheme was given effect to during the year under review. Eight Research Scholars, of whom three were Senior and five Junior, were appointed under the scheme, and part of the money was utilized in the purchase of scientific equipment and chemicals. In August, 1950, the Government of India, Department of Scientific Research, sanctioned a further sum of Rs. 15,400 for instituting a number of Senior and Junior Scholarships, out of which 2 Senior and 2 Junior Scholars were appointed to the Department of X-rays and Magnetism, 1 Senior and 2 Junior Scholars to the Department of Optics, 1 Senior and 2 Junior Scholars to the Department of Physical Chemistry and 4 Senior Scholars to the Department of Organic Chemistry. These scholarships sanctioned in August have been placed on a 3-year basis, and it is expected that the scheme would successfully contribute to the training of qualified research workers, of which there is a great scarcity at the present moment.

Sir P. C. Ray—Bengal Chemical Research Scholarships : Sri Nakuleswar Kundu continued as Sir P. C. Ray—Bengal Chemical Research Scholar.

Doctorate Degrees Received During the Year

During the year under review, Dr. B. K. Banerjee, of the Department of X-rays and Magnetism, and Dr. Pijush Kanti Chaudhury and Dr. Ranajit Sen Gupta, of the Department of Physical Chemistry, were admitted to the D. Phil Degree of the Calcutta University for researches on X-ray studies of glass, cellulose acetate derived from Indian cotton, and on kinetics of polymerization respectively.

Medals and Professorship Lectures

During the year under review, Dr. E. G. Bowen, Chief of the Division of Radio Physics, Commonwealth Scientific and Industrial Research Organization, Australia, delivered a course of two lectures as Coochbehar Professor of the Association for 1946 on "Studies in Natural and Artificial Rain Formation" in January, 1951.

Dr. L. Fieser, Professor of Chemistry, Harvard University, delivered a course of two lectures as Coochbehar Professor for 1947 on "Lapinone, a New Antimalarial" in January, 1951.

The Association's Ripon Professorship lectures were delivered in January 1951 by Prof. E. Amaldi, of Consiglio Nazionale Delle Ricerche, Centro di Studio per la Fisica Nucleare, Rome, on "Diffraction Effects in the Scattering of Neutrons, Mesons and Electrons by Nuclei."

The Council invited Prof. P. C. Mahalanobis, F.R.S., to deliver the Joykissen Mookerjee Gold Medal Lectures for 1949.

The Bimala Churn Law Gold Medal for 1951 was offered to Prof. Enrico Fermi, N.L., Professor of Physics, University of Chicago, Chicago, U.S.A.

Symposia and Lectures

A series of weekly lectures, in which one of the members of the research staff reported on the subject of his research, were organized during the year as in the previous year. The following lectures were held :—

<i>Subject</i>	<i>Speaker</i>	<i>Department</i>
1. Technique of Fourier synthesis of crystal structure.	Prof. K. Banerjee	X-ray & Magnetism
2. Raman Spectra of substituted benzene compounds in the solid state.	Mr. A. K. Ray	Optics
3. Silicones	Mr. P. K. Dutt	Physical Chemistry
4. Metal-Ammonia Reduction	Dr. S. M. Mukherji	Organic Chemistry
5. Measurement of Osmotic Pressure of High Polymers.	Mr. S. V. S. Ratnam	Physical Chemistry
6. Determination of Particle size by X-ray diffraction.	Mr. N. N. Gupta	X-ray & Magnetism
7. Vitamin D.	Mr. P. Bagchi	Organic Chemistry
8. Projection in Crystallography.	Mr. S. C. Mitra	X-ray & Magnetism
9. Acid-Base reactions in non-aqueous medium.	Mr. M. N. Das	Physical Chemistry
10. Chromatography	Dr. K. N. S. Sastri	Organic Chemistry
11. X-ray analysis of Minerals	Mr. G. B. Mitra	X-ray & Magnetism
12. Nuclear Forces	Dr. D. Basu	Theoretical Physics
13. Fundamental Particles ..	Prof. S. C. Sirkar	Optics

In addition to the above lectures, a series of lectures by distinguished chemists were also organized at the initiative of the Department of Organic Chemistry during the summer months. The following lectures were delivered :—

Synthesis of Oestrone ..	Dr. D. K. Banerjee, Prof. of Organic Chemistry, College of Engineering & Technology, Jadavpur.
Ion Exchange	Dr. A. C. Ganguly, University College of Science, Calcutta.
Mimosa Hormone	Dr. B. Banerjee, Senior Research Fellow, Bose Research Institute, Calcutta.

Prof. V. V. Narlikar, Professor of Mathematics, of the Banaras Hindu University, delivered a lecture on the 'Affine Field Laws'.

Library

There was a fresh addition of books, periodicals and bulletins to the library stock. The greater part of the library was shifted to the new building in January, 1951, and is now housed on the second floor of the building in a comparatively commodious hall. The Association continued to receive 101

journals in exchange of the *Indian Journal of Physics and the Proceedings of the Indian Association for the Cultivation of Science* and in addition, subscribed to 84 periodicals. Further, 21 periodicals and bulletins were received as complimentary copies. During the year, Unesco Book coupons worth \$300 dollars were purchased, and 139 new books were added to the Library stock.

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

During the period April 1950 to March 1951, 11 issues of the journal were published, 10 for 1950 and 1 for 1951. This increased the arrear in publication by about a month, which is due to a strike in the Calcutta University Press.

The number of subscribers was 110 through the Indian Physical Society, 64 others in India and 186 abroad. The corresponding figures in the preceding year were 110, 62 and 177 respectively.

The year of the *Journal* continued to be the calendar year. During 1950, 82 papers were received for publication, as against 62 in the preceding year. Of these 70 were accepted after editorial revision, three after modification. One paper is under consideration. 69 papers and one article as Proceedings of the Indian Association for the Cultivation of Science were published in 1950 (18 of which were carried over from 1949). These comprised 587 pages plus 37 plates as against 566 pages and 35 plates in 1949.

The Board of Editors consisted of the following members: Prof. K. Banerjee, Dr. D. M. Bose, Prof. S. N. Bose, Dr. D. S. Kothari, Prof. S. K. Mitra, Prof. P. Ray, Prof. M. N. Saha, and Prof. S. C. Sircar (Secretary).

Donations and Grants-in-Aid

We gratefully acknowledge the receipt of the following grants-in-aid during the year 1950-51:

- (i) Capital grant of Rs. 2,50,000/- from the Government of West Bengal towards the cost of construction of the new Research Laboratory Buildings of the Association at Jadavpur.
- (ii) Recurring grant of Rs. 2,66,000/- from the Government of India for 1950-51 (as against Rs. 2,56,025/- received during the year 1949-50).
- (iii) Special contribution of Rs. 13,300/- towards dearness allowance to the employees of the Association.
- (iv) Non-recurring grant of Rs. 15,400/- from the Government of India for the Development of Research Training Facilities.
- (v) A grant of Rs. 9,511/9/- from the Council of Scientific and Industrial Research for the Scheme "X-ray investigation on Coal" for the year 1950-51.

N.B.—Out of Rs. 9,511/9/-, the sum of Rs. 4,033/- was received on 9-4-51.

(vi) A grant of Rs. 4,126/4/- from the Council of Scientific and Industrial Research for the Scheme "Construction of Osmometers suitable for High Polymer Research" for the year 1950-51.

(vii) A grant of Rs. 800/- from the National Institute of Sciences of India through the Indian Physical Society for the year 1950-51.

Acknowledgements

The Council wish to record their deep appreciation and sincerest thanks to Prof. M. N. Saha, the retiring President, Prof. P. Ray, Dr. B. C. Guha, Prof. S. K. Mitra and Prof. S. K. Ray, retiring ordinary members of the Council ; Sri M. S. Bhatnagar, Joint-Secretary, Ministry of Finance, Govt. of India, retiring nominee of the Govt. of India and to Prof. S. R. Palit, the retiring Professor Member, for their services to the cause of the Association.

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

Our grateful thanks are also due to the University of Calcutta for printing the *Indian Journal of Physics* and Proceedings of the Indian Association for the Cultivation of Science free of cost, to the Calcutta Corporation for exemption of municipal taxes in respect of the Laboratory Buildings, and to members of the Board of Trustees for their ungrudging services throughout the year.

II. RESEARCH WORK CARRIED OUT IN THE DEPARTMENTS DURING THE FINANCIAL YEAR 1950-51

A. DEPARTMENT OF X-RAYS AND MAGNETISM

Research work of the Department was particularly hampered due to transfer of the laboratories from Bowbazar to Jadavpur. However, investigations on the following subjects have been carried out during the year under review :

- (1) Determination of Elastic Constants of Crystals, from the study of Diffuse Reflections of X-rays.
- (2) Determination of Crystalline Structure.
- (3) X-ray Study of Glass.
- (4) X-ray Study of Coal.
- (5) Study of Low Angle Scattering of X-rays.
- (6) Crystal Magnetism.
- (7) Electrical and Magnetic Properties of Semi-conductors.
- (8) Generation of Low Temperatures.

Determination of Elastic Constants by X-rays

Studies on the extra reflection in Laue photographs has been continued by R. K. Sen. For finding the elastic constants of crystals, determination of the absolute intensity distribution of the extra reflections has been made in the case of benzil by comparing the intensities of the diffuse reflections with those of the powder lines of aluminium sprayed on the surface of the crystal. The ratio of

the volume of the crystal to that of the aluminium powder is determined by comparing the aluminium powder line with a Bragg reflection of known intensity. Considerable progress has been made in the determination of the elastic constants of benzil from the absolute intensity distribution thus obtained.

Determination of Crystalline Structures

B. S. Basak has completed the determination of the structure of phenanthrene crystal by the Fourier Synthesis method. On the basis of the structure deduced from the electron density projection on the 001 plane carried out during the previous year, phases of terms for the projection along the *a*-axis have been obtained. After some trials a clear projection along the *a*-axis has been obtained. From these two projections the molecule is found to be planar as expected. The bond lengths have values between 1.36-1.43 A.U. and the bond angles between 114°-125° except the bond joining the two outer benzene rings and the bond opposite to this in the central benzene ring. The former being 1.56 A.U. and the latter 1.32 A.U. The results explain very nicely the chemical behaviour of this substance.

B. V. Ramanamurti and D. R. Dasgupta are engaged in carrying out three dimensional analysis of the structure of anthraquinone and sulphur respectively in order to determine the atomic positions accurately. They have prepared a complete set of Beevers-Lipson strips and are engaged in making the necessary intensity measurements.

X-ray Study of Glass

Continuing his X-ray and physico-chemical studies of glass systems, B. K. Banerjee has carried out investigations on the system of borato-fluoride glass containing NaF, KF, LiF and RbF as one of the constituents. A very low angle band has been observed which is under investigation. The work on the determination of structure of dehydrated products of different thermal history is in progress.

X-ray Diffraction of Coal

In course of the experiments on carbonization of organic compounds, N. N. Gupta subjected some organic substances to high pressure for a long time at about 1000°C. The X-ray diffraction diagram of these products has shown that they have been transformed into graphite. This is very remarkable in view of the fact that Acheson graphite is produced at about 3000°C.

X-ray diffraction study of a sample of coal from Jharia field, Ranigunj series carried out by G. B. Mitra has shown the presence of dickite, quartz, augite, purite, bauxite, chloropatite and grossular. The clay minerals have been found to be present in a fine state while quartz is present as coarse grains.

Study of Low Angle Scattering of X-rays

By a simple device, J. N. Maitra has been successful in photographing monochromatized scattered radiation at an extremely low angle of the order of

a minute. The method is being adapted for the use of a photomultiplier tube for a continuous survey of low angle scattering. The method is thus expected to be very useful for the X-ray study of high polymers.

Crystal Magnetism

S. C. Mitra investigated the paramagnetic behaviour of some iron group salts at high temperatures upto their transition points as well as at low temperature. His results indicate that much of the apparent variations in the crystalline electric fields in these salts, which were previously ascribed to the action of distant atoms, are actually due to change of the relative orientation of the ionic groups with temperature, as the action of the distant atoms on the paramagnetic ions as estimated from these results were found to be too small to be of importance in the temperature range investigated.

A. K. Banerjee has studied a number of paramagnetic atoms of the iron group. Though the crystals of the alums show no magnetic anisotropy, he has found that the effects of the small unquenched orbital moments and the small quenching of the spin moments owing to the coupling between spin and orbital moments cause small deviations from the ideal Curie Law of temperature variation.

Cryogenics

Fair progress has been made in the construction of a hydrogen liquefier by A. Bose. New types of all-metal cylindrical Dewar vessels, one of about 3 litre and another of about 10 litre capacity have been constructed and found to have very high efficiency. Charcoal purifier trap and heat exchanger coils for the liquefier are now in course of construction.

A new type of all-glass two-stage mercury pump of simple construction was developed by A. Bose and A. K. Dutta which has been found to work satisfactorily, particularly for evacuating the Dewar vessels.

Electrical Properties of Semi-conductors

The investigations on the electrical conductivities of semi-conducting crystals at different temperatures both high and low were continued by A. K. Dutta. The most important crystals that are being studied include carborundum, graphite, etc.

I. List of Papers Published

1. Crystal Structure of Phenanthrene—B. S. Basak, *Ind. J. Phys.* **24**, 309 (1950).
2. Recent development in the study of Glassy state, Part I—B. K. Banerjee, *Sci. Cult.*, **16**, 178 (1950).
3. Recent developments in the study of Glassy state, Part II—B. K. Banerjee, **16**, 241 (1950).
4. Formation of Graphite at 1000°C.—N. N. Gupta, *J. Sci. Indus. Res.*, **5**, 122 (1951).
3. On a method of studying small angle scattering of mono-chromatic X-rays—K. Banerjee and J. C. Maitra, *Ind. J. Phys.*, **25**, 141 (1951).

II. List of Papers Communicated for Publications

1. A two-stage mercury diffusion pump of simple construction—A. K. Dutta—communicated for publication in the *J. Sci. Instr.*
2. On a method of studying small angle scattering of monochromatic X-rays—K. Banerjee and J. C. Maitra, communicated for publication in *Sci. Cult.*

B. DEPARTMENT OF OPTICS

The investigations carried out in this department during 1950-51 can be classified under following headings:—

- (1) Brillouin Component in Light Scattered by Crystals.
- (2) Origin of new Low-Frequency Raman lines of Organic Crystals.
- (3) Raman Spectra of Organic Compounds in the Vapour State.
- (4) Ultraviolet Absorption Spectra of Organic Compounds in the Solid state at Low Temperatures.
- (5) Absorption of U.H.F. Radio Waves in Liquids and Binary Liquid Mixtures.

Brillouin Component in Light Scattered by Crystals

It was pointed out by some previous workers that the separation of Brillouin components from each other in the case of light scattered by quartz is of the order of a few wave numbers and that the intensity of these components is only of the order of 1/100th of that of the central component. The problem has been re-investigated by Sirkar and Kastha using a 12-ft. concave grating having a resolving power of 150,000 in the third order and 4358Å line of Hg as the incident light. It has been found that the Rayleigh line is split up into two components and the central component is absent. Also, the shift is much less than that reported by previous workers. It is pointed out that the method used by previous workers is responsible for producing some new components of the Rayleigh line, which are actually not Brillouin components.

Origin of Low-frequency Raman Lines of Organic Crystals

In continuation of his work in the previous year, A. K. Ray has studied the Raman spectra of naphthalene, ethyl benzene and benzyl chloride in the solid state at different low temperatures. The behaviour of the low-frequency lines observed in the case of naphthalene show that there is weak coupling between molecules in the lattice and that the Raman lines due to intramolecular oscillations are produced by vibrations of single molecules having no phase relation with the oscillations of their neighbours. The results observed in the case of the other two compounds show that the frequency of the low-frequency lines is not determined by the moment of inertia of the molecule and therefore they are not due to angular oscillation of the molecule in the lattice field. They may be due to oscillations in groups of associated molecules.

Raman Spectra of Organic Compounds in the Vapour State

The Raman spectra of CH_2Cl_2 and CHCl_3 in the vapour state have been studied by M. V. Rao, and compared with the Raman spectra of the liquids at

the same temperature as those of the vapours. The results show that some of the prominent Raman lines undergo changes in intensity and position with the change in state.

Ultraviolet Absorption Spectra of Organic Compounds in the Solid State at Low Temperatures

The ultraviolet absorption spectrum of anisole in the solid state at low temperature has been studied by A. R. Deb. On comparing the spectrum with that of the liquid it is found that there are changes in the number and positions of the absorption bands. Similar changes have been observed in the case of toluene by H. N. Swamy. He has also found that the results reported by previous workers in the case of solid toluene are not correct. It has been suggested that the observed changes in the absorption spectra are due to intermolecular association in the solid state.

Absorption of U.H.F. Radio Waves in Liquids and Binary Liquid Mixtures

(256-570 MC/S) In continuation of his previous work, S. N. Sen has studied the absorption of U.H.F. radio waves in diethyl ketone, dinormal propyl ketone and ethyl isobutyl ketone at temperatures ranging from 0°C to 95°C. In each case an absorption peak has been observed and it changes in position, width and height with change of temperature. He has also studied similar absorption in solutions of some aliphatic ketones in non-polar solvents. The absorption peaks are observed to shift towards higher frequencies and to diminish in height with rise of temperature. The results are explained on the basis of association of the molecules in the pure liquid.

Sirkar and Choudhury studied the absorption of U.H.F. radio waves in opalescent binary mixtures of (1) nitro benzene plus hexane and (2) aniline plus cyclohexane. In each case, besides a lower peak in the position of the peak observed in the case of the pure liquid, a new peak on the lower frequency side is observed. It is concluded that in such mixtures the polar molecules form two types of groups, in one type the intermolecular field being the same as in the pure liquid while on the other type the field is higher.

I. List of Papers Published

1. The Raman Spectra of Trichloro-ethylene and Tetra-chloroethylene in the solid state—By S. B. Sanyal, *Ind. J. Phys.*, **24**, 151 (1950).
2. Absorption of U. H. F. Radio waves in some substituted Benzene compounds—By S. N. Sen, *Ind. J. Phys.*, **24**, 163 (1950).
3. On the Raman spectra and Heat capacity of Benzene at low Temperatures—By S. C. Sirkar and A. K. Roy, *Ind. J. Phys.*, **24**, 189 (1950).
4. On the Raman spectra of three mono-substituted n-Butane compounds in the solid state—By S. B. Sanyal, *Ind. J. Phys.*, **24**, 378 (1950).
5. On the origin of Fluorescence in Diamond—By B. M. Bishui, *Ind. J. Phys.*, **24**, 441 (1950).
6. Brillouin components in Light scattered by Quartz—By S. C. Sirkar and G. S. Kastha, *Nature*, **166**, 1073 (1950).
7. Nature of Grouping of Molecules in Opalescent Binary Liquid mixtures—By S. C. Sirkar and Anjali (Miss) Choudhury, *Nature*, **167**, 198 (1951).

8. On the Absorption of U. H. F. Radio waves by Opalescent Binary Liquid mixtures—By (Miss) Anjali Choudhury, *Ind. J. Phys.*, **24**, 507 (1950).
9. On the Raman spectra of Naphthalene at Low Temperatures—By A. K. Ray, *Ind. J. Phys.*, **24**, 539 (1950).
10. On the Absorption of U. H. F. Radio Waves by some Aliphatic Ketones—By S. N. Sen, *Ind. J. Physics*, **25**, 25 (1951).
11. A note on the Raman Spectra of CH_2Cl_2 and CHCl_3 in the Vapour State—By M. V. Rao, *Ind. J. Physics*, **25**, 61 (1951).
12. On the Origin of Low-Frequency Raman Lines in Organic Crystals—By S. C. Sirkar, *J. Chem. Phys.*, **19**, 256 (1951).
13. Raman Spectra of organic crystals at different Low Temperatures II Ethyl benzene and Benzyl chloride—By A. K. Ray, *Ind. J. Phys.*, **25**, 131 (1951).

II. List of Papers Communicated for Publication

1. On the Absorption of U. H. F. Radio Waves in some aliphatic Ketones dissolved in non-polar solvents—By S. N. Sen, *Ind. J. Phys.*, **25**, in press.
2. On the Ultraviolet Absorption spectra of Anisole in the liquid and solid states—By A. R. Deb, *Ind. J. Phys.*, **25**, in press.
3. On the Absorption Spectra of Toluene in the Liquid and Solid States—By H. N. Swamy, *Ind. J. Phys.*, **25**, in press.

C. DEPARTMENT OF PHYSICAL CHEMISTRY

The following are the chief problems on which work has been under active progress in the laboratory during the year under review :

High Polymer Chemistry :

- (1) Ferric soaps as catalyst in vinyl polymerization.
- (2) Chain transfer studies in vinyl polymerization.
- (3) Cellulose chemistry including benzyl cellulose and triphenyl methyl cellulose.
- (4) Polyelectrolytes including gum arabic, chitin, etc.
- (5) Silicones and stannones.

Detergents and Surface Active Agents :

- (6) Solubilization phenomenon.

General Physical Chemistry :

- (7) Dielectric constant and dipole moment measurements.
- (8) Indicator studies in non-aqueous solvents.
- (9) Non-aqueous titration of acids and bases.
- (10) Studies in kinetics of Menshutkin's reaction.

Biochemistry :

- (11) Assessment of enzyme deactivation by iodimetric method.
- (12) Studies in Protein-detergent complexes.

Ferric Soaps as Catalyst in Vinyl Polymerization

In continuation of the work on the effect of metallic soaps on polymerization, J. N. Sen has studied the catalytic behaviour of ferric soaps (viz., laurate, oleate, stearate) on the polymerization of styrene, and methyl methacrylate.

The results have established some points which may be helpful in the elucidation of the mechanism of the reaction. Further work is in progress.

Chain Transfer Studies in Vinyl Polymerization

Chain transfer reaction in the polymerization of methyl acrylate and styrene in about 30 solvents has been studied by J. N. Sen and S. Basu. The chain transfer constants for the different solvents have been determined. Polymerization of methyl methacrylate in toluene solution in presence of benzoyl peroxide catalyst has been studied and it has been found that the chain transfer constant of toluene remained the same even in presence of the catalyst. Further work on catalyzed polymerization of different monomers in various solvents is under active progress.

Cellulose Chemistry including Benzyl Cellulose and Triphenyl Methyl Cellulose

H. B. Roy and S. Basu continued their studies on the structure and physico-chemical properties of Benzyl cellulose. The results have yielded some interesting information about the structure of the cellulose samples used and also the structure of the benzyl ethers derived therefrom.

Triphenyl methyl ethers of cellulose and methyl ethyl cellulose have been prepared by S. Basu and Dilip K. Roy Choudhuri from absorbent cotton and edifas respectively. The viscometric measurements of chloroform solution of these compounds showed that the intrinsic viscosities were extremely low in comparison with their molecular weights determined by the osmotic pressure method in the same solvent. Comparative study of the intrinsic viscosities, axial ratios and molecular lengths of these substances with those of other polymers, especially, cellulose acetate on the one hand and proteins on the other, has shown that these substances are extensively coiled up in solution and the straight cellulose chain becomes extremely deformed in its triphenyl methyl derivatives. Fractionation of these compounds is under way.

Polyelectrolytes including Gum Arabic, Chitin, etc.

Sodium alginate, sodium jute-hemicellulose, sodium arabate have been studied in all its details with reference to pH and salt-effect on the viscosity of their solutions by P. Das Gupta and S. Basu. Conductivity and the effect of salt on the conductivity of the solution of sodium alginate and sodium jute-hemicellulose have also been studied. From the results these substances are proved to behave as polyelectrolytes. The work with other natural gums and chitosan salts is in progress.

Silicones and stannones

Work on the preparation of silicones by catalytic method has been undertaken by P. K. Dutt and S. Basu. Various silicone oils have been obtained. The analysis and detailed study of these fluids are in progress.

Investigations in the preparations of high polymers from organic tin compounds are being made by A. Bhattacharya and S. Basu. The various products obtained are being studied.

Solubilization Phenomenon

Work on solubilization of water in non-polar solvents of cationic detergents is being continued. The effect of additives like long chain amine and fatty acids on solubilization, effect of temperature, effects of solvents and their mixtures, have been studied. Viscosity and freezing point measurements of solubilized systems confirmed that soap micelles incorporate the insoluble material. In analogy with mixture of solvents where a marked rise in solubilizing power was observed, mixtures of poor solubilizers also showed great increase in the amount of water dissolved. The work is being pursued by V. Venkateswarlu.

Dielectric Constant and Dipole Moment Measurement

Ordinary method of calculating polarization from solution data e.g. ϵ , ϕ_{12} , n requires the assumption of laws of mixtures to be valid in the case of polarisation and also linear variation of ϵ , d_{12} etc., with concentration. These assumptions are questionable. Moreover, the method of extrapolation is also attended with uncertainty so far as the computation of $P_2 \propto$ is concerned. Since polarization is expressed in volume units, it can be easily suggested that methods similar to that used in thermodynamics in calculating partial molal volume in binary mixtures may be applied for computing polarization from solution measurements. Thus in this laboratory, a theoretically sound method of calculating polarization at infinite dilution and hence dipole moment either graphically or analytically has been obtained. Three methods of extrapolation have been suggested to obtain the limiting slope, $(dp_{12}/dw_2)_{w_2 \rightarrow 0}$. Firstly, a simple plot of p_{12} against w_2 , secondly a graphical extrapolation of $\frac{\Delta}{w_2}$, where $\Delta = p_{12} - p_1$, versus w_2 and thirdly, a graphical extrapolation of $\frac{1}{w_2} \log_e (p_{12}/p_1)$ against w_2 . This gives partial sp. polarization of the solute at infinite dilution which when multiplied by the molecular weight of the solute, gives true polarization of the solute.

Indicator Studies in Non-Aqueous Solvents

The study of behaviour of indicators in non-aqueous media has been undertaken by U.S. Nandi, with about 70 indicators. Preliminary results indicate that α -Naphtholphthalein, bromothymol blue, thymolphthalein, etc., behave well only in case of free alkali whereas methyl orange, xylene cyanol, thymol blue, dimethyl yellow and others are suitable for all. In the case of tertiary amine and combined alkali bromophenol blue behaves as a good indicator. The work is being continued.

Non-Aqueous Titration of Acids and Bases

M. N. Das continued his work on titration of acids and bases in non-aqueous media. Several weak bases including amino-acids and alkaloids have been successfully titrated. A monograph on non-aqueous titrations has been prepared and awaits publication.

Studies on Kinetics of Menshutkin Reaction

S. Mukherjee has completed the study of effect of solvent and chain lengths of aliphatic alkyl bromides at different temperatures on the reaction between pyridine and long chain aliphatic alkyl bromides. It has been found that the rate of reaction increases from non-polar to polar solvent and practically there is no change in the velocity of reaction when chain length of the alkyl bromide is increased from C₄ to C₈.

Assessment of Enzyme Deactivation by Iodimetric Method

Recently, the work on deactivation of enzyme, *e.g.*, trypsin, rennetin, lipase, diastase by heat, inorganic salts, acids, and alkalies has also been undertaken by S. K. Mukherjee and S. Basu in continuation of the work on deactivation of pepsin done by S. P. Nandi and S. Basu. The degree of deactivation is measured by iodimetric method.

Studies in Protein-Detergent Complexes

The formation of protein complexes with long paraffin chain salts is being investigated by G. C. Bhattacharya and S. Basu. One complex with gelatin and dodecyl sodium sulphate has been isolated and its physicochemical properties have been studied. Attempts to prepare complexes with other proteins and detergents are in progress.

I. List of Papers Published

1. Kinetics of halogenation of fatty acids, Part II. Bromination of acetic acid—by M. N. Das and Santi R. Palit, *J. Ind. Chem. Soc.*, **27**, 179 (1950).
2. On the kinetics of long chain quaternary salt formation—By Sushil Kumar Mukherjee and Santi R. Palit, *J. Ind. Chem. Soc.*, **27**, 175 (1950).
3. A note on polymerization initiated by free radicals obtained by electrolysis—By M. N. Das and Santi R. Palit, *Sci. and Culture*, **116**, 34 (1950).
4. Molecular weight of nylon by end group method—By Sadhan Basu, *J. Polymer Sci.*, **5**, (1950).
5. Dipole moment of cetallie soaps—By Birendra Ch. Banerjee and Santi R. Palit, *J. Ind. Chem. Soc.*, **27**, 385 (1950).
6. Degree of polymerization and chain transfer in methyl methacrylate—by Sadhan Basu, Jyotirindra Nath Sen, and Santi R. Palit, *Proc. Roy. Soc.*, **A202**, 487 (1950).
7. Ferric soaps as catalyst for vinyl polymerization—by Jyotirindra Nath Sen and Santi R. Palit, *Nature*, **166**, 603 (1950).
8. Studies of the optical properties of shellac solutions. Depolarization of scattered light—By Sadhan Basu, *J. Phys. & Coll. Chem.*, **54**, 1358 (1950).
9. Auto-condensation of polyhydroxy acids—By Sadhan Basu, *J. Sci. Ind. Res.* (1951).
10. Solubility and degree of polymerization of cellulose acetate during acetylation and hydrolysis; Part I cellulose from short staple Indian cotton—By Pijush Kanti Choudhury and Santi R. Palit, *J. Sci. & Ind. Res.*, **10B**, 110 (1951).

II. List of Papers Communicated for Publication

1. Solubilization of water in nonpolar organic solvents by dodecyl amino salts—By V. Venkateswarlu and Santi R. Palit, *Proc. Roy. Soc.* (accepted for publication).
2. Soaps: Their unique dissolving power—By Santi R. Palit and V. Venkateswarlu, *Ind. Soap Journal* (article by invitation).

3. Protein denaturation and pepsin deactivation—By Sadhan Basu and S. P. Nandi, *Enzymologia* (accepted for publication).
4. Calculation of polarization and dipole moment from solution data—By Santi R. Palit and Birendra Ch. Banerjee, *Trans. Farad. Soc.* (accepted for publication).
5. Viscometry of sodium thymonucleate—By Sadhan Basu.
6. Viscometric and osmometric molecular weight of benzyl cellulose—By H. B. Roy and Sadhan Basu.
7. Viscometric and osmometric molecular weight of methyl acrylate—By J. N. Sen, S. R. Chatterjee and Santi R. Palit.
8. Viscometric study of gum arabate—By Sadhan Basu, Pares Ch. Das Gupta and Anil K. Sircar.
9. Deformation of cellulose molecule in its triphenyl methyl derivative—By Sadhan Basu and Dilip K. Roy Choudhury.
10. Comparative study of Potassium Persulphate and Benzyl peroxide as Initiators of polymerization in solution—By Ranajit Sen Gupta and Santi R. Palit.

D. DEPARTMENT OF ORGANIC CHEMISTRY

The laboratory of the Department of Organic Chemistry started functioning from June, 1950 in a sort of make-shift arrangement at the premises of 210, Bowbazar Street. Within this short time, however, considerable progress was made in the research work and some important observations made mainly under the following heads:

A. Friedel-Crafts Reaction Involving Unsaturated Ketones

1. Fundamental studies on this reaction by Sri N. K. Bhattacharyya has evolved a satisfactory theory on the course of the reaction embracing normal as well as apparently abnormal type of products.

2. A new method of phenanthrene synthesis—

A new and elegant method of synthesis of phenanthrene derivatives has been developed by Sri N. K. Bhattacharyya and several phenanthrene derivatives such as 1:4-dimethyl-phenanthrene, 9-methyl-phenanthrene, etc., have been synthesised by this method. Sri P. N. Rao, following this method has synthesized 2-methyl-3:4-benzphenanthrene, one of the most potent carcinogens. This synthesis is a very novel one as the previous syntheses of this hydrocarbon by other authors are much more laborious and they involve large number of steps.

3. Polyphenyls:

By an extension of the Friedel-Crafts Reaction to cyclohexenylcyclohexanone Sri B. K. Ganguly is developing a new general method of synthesis of polyphenyls by a process of enlargement of the chain of polyphenyl systems by two units, as it were.

B. Gonadogens

1. Steroid hormones:

Some pilot experiments towards synthesis of testosterone class of steroid hormones have been made by Sri B. K. Ganguly. Further experiments in this regard are in progress.

Sri P. Dutta is actively engaged in synthetic experiments which may eventually end in a new synthesis of doisyolic acid, an oestrogen.

2. Synthetic gonadogens :

Sri B. K. Ganguly is engaged in synthesis of the tetra-hydro-hexesterol analogues which are expected to be androgenic in view of the similar activity found in tetrahydro-hexesterol (Birch & Mukherji).

Sri N. K. Bhattacharyya is pursuing a new method of synthesis of hexesterol, the well-known synthetic oestrogen.

C. Antibiotics

Attempts are being made to develop a new method for synthesis of chloramphenicol (chloromycetin) and its analogues. Some significant progress has been made by Sri Pravash K. Dutta along this line. Work is still being actively pursued.

D. Anticarcinogens

Synthetic investigation on the derivatives of hydroaromatic 3:4-benzphenanthrene systems are being made by Sri Rao, with the expectation that these substances may be of value as anticarcinogens.

E. Sri P. Bagchi and Sri D. K. Dutta have been engaged in studies in cyclisation and syntheses of perhydrophenanthrene systems, Marvel's ketone and 6-substituted coumalins.

F. Terpenes

1. Monoterpenes :

A number of monoterpenes such as α -terpinene, phellandrene, phellandral, etc., are being synthesized by Sri P. Talukder by taking advantage of metal-ammonia reduction process (Birch & Mukherji) and considerable progress have already been made in this concern.

2. Sesquiterpenes :

Sri N. K. Bhattacharyya has solved the problem of an intriguing structural situation that has arisen regarding the structure of the monocyclic sesquiterpene hydrocarbon, zingiberene. He has demonstrated through an unambiguous synthesis of the new structure, its structural identity with the natural substance.

Sri P. Talukder has undertaken synthetical investigation in the cadinene group of sesquiterpenes by way of metal-ammonia reduction process of Birch and Mukherji. Experiments in this regard are in satisfactory progress.

I. List of Papers Published.

1. Structure of zingiberene—By S. M. Mukherji, *Science & Culture*, **15**, 403 (1950).
2. Chemistry of Coal Tar Resins (A Discussion)—By S. M. Mukherji, *Science & Culture*, **15**, 420 (1950).
3. Chromatographic adsorption analysis (A Review)—By K. N. S. Sastry, *Science & Culture*, **16**(3), 94 (1950).
4. Studies in sesquiterpenes—By N. K. Bhattacharyya and S. M. Mukherji, *Science & Culture*, **16**, 269 (1950).
5. A new route to Polycyclics—By N. K. Bhattacharyya and S. M. Mukherji, *Science & Culture*, **16**, 374 (1951).
6. Metal-Ammonia Reduction—By B. K. Ganguly and S. M. Mukherji, *Science & Culture*, **16**, 374 (1951).

II. List of Papers Communicated for Publication.

1. New syntheses of 1:4-dimethyl-phenanthrene and 9-methyl-phenanthrene—By N. K. Bhattacharyya and S. M. Mukherji, *Experientia*, accepted for publication).
2. A novel synthesis of the carcinogen, 2-methyl-3:4-benzphenanthrene—By S. M. Mukherji and P. N. Rao, *Nature*, in the press.
3. Studies in Cadinene group of sesquiterpenes—By P. Talukder, *Science & Culture*, in the press.
4. A new method of synthesis of polyphenyls—By B. K. Ganguly and S. M. Mukherji, *Nature*, in the press.
5. A novel synthesis of Cadalene—By N. K. Bhattacharyya.
6. Synthesis of 2-methyl-6-(4'-methyl-cyclohexa-2':4'-dienyl)-hept-2-ene and its structural identity with natural zingiberene—By N. K. Bhattacharyya and S. M. Mukherji.
7. A new approach towards synthesis of chloramphenicol and its analogues—By Pravash K. Dutta and S. M. Mukherji.
8. Antibiotics—A Review—By Pravash K. Dutta.
9. Study of Friedel-Crafts reaction between m-cresol methyl ether and succinic anhydride—By D. K. Datta and P. Bagchi.

E. DEPARTMENT OF THEORETICAL PHYSICS

The Department of Theoretical Physics formally started on the 28th July 1950 with the joining of Dr. D. Basu as Reader in Theoretical Physics. The Department in the early stage felt the want of space until the Association moved in February 1951 to its new premises at 2 & 3 Lady Willingdon Road, Calcutta—32.

Dr. D. Basu worked alone in the Department as none of his staff joined in the period under report.

Dr. D. Basu has made investigations on the type of the nuclear interaction which gives reasonable agreement to the values of the neutron-proton scattering cross section at 280 Mev neutron energy. The problem of finding the right type of interaction between two nucleons is of fundamental importance, there is yet no satisfactory theory that can explain all the basic nuclear facts. The symmetrical Möller-Rosenfeld interaction, though not free from shortcomings, has the special advantage that by eliminating the $1/r^3$ singularity admits of a solution of the Schrödinger equation for the deuteron problem; which fixes uniquely the two constants of the M. R. interaction. The third constant involves the mass of the meson that generates the field, the mass value which has the nearest claim to being put is the one of the π -meson because the nuclear collisions at energies with which we are now concerned produce only π -mesons whose mass is 286 me. The three constants of the M. R. interaction being thus fixed, it is found that the theoretical value of the total scattering cross section agrees reasonably well with the recent experimental findings of neutron-proton scattering at 280 Mev neutron energy provided the influence of radiation reactions is properly taken into account.

Paper Communicated for Publication.

On the Relativistic Scattering of Neutrons by Protons—By D. Basu, *Ind. Jour. Phys.*, Vol. 25, (in press) (1951).

P. RAY,
Honorary Director.

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

List of Books and Journals added during 1950-51

A. LIST OF BOOKS

Author	Title
1. Remick, A. Edward ...	Electronic interpretations of organic chemistry.
2. Dewar, M. J. S. ...	Electronic theory of organic chemistry.
3. ...	Catalogue of optical and scientific instruments and dictionary.
4. Krumbhaar, Dr. Wm. ...	Coating and ink resins.
5. Jacobson, C. A. (Edt.) ...	Encyclopedia of chemical reactions, vol. 3.
6. Oliphant; Blackett etc. ...	The atomic age.
7. Verstone, P. E. ...	The manufacture of paper containers.
8. Bennett, H. ...	Practical emulsions.
9. Niederl, J. B. & Niederl, V. ...	Micromethods of quantitative organic analysis.
10. Dole, Malcolm ...	The glass electrode : methods, applications and theory.
11. Marsh, J. T. ...	An introduction to textile finishing.
12. Whyte, Lancelot Law ...	The Universal principle in physics and biology.
13. Poultney, S. V. ...	Vinegar products.
14. Corbeiller, P. Le ...	Matrix analysis of electric networks.
15. Leet, L. Don ...	Earth waves.
16. Zworykin, V. K. & others ...	Electron optics and the electron microscope.
17. Penn, W. ...	High polymeric chemistry.
18. Dana ...	Dana's manual of mineralogy.
19. Kirk, R. E. & others ...	Encyclopedia of chemical technology, vol. 3.
20. Bodansky, Meyer ...	Introduction to physiological chemistry.
21. Baitsell, George A. ...	Science in Progress, 6th series.
22. Joliot-Curie, Frederic ...	Dix ans d'application de la radioactivite artificielle.
23. Burchhardt, J. J. ...	Die bewegungsgruppen der kristallographie.
24. Farkas, A. (Edt.) ...	Physical chemistry of hydrocarbons, vol. 1.
25. Mark, H. & Proskauer, E. S. ...	The science of plastics.
26. Wu, Ta-You ...	Vibrational spectra and structure of polyatomic molecules.
27. Dept. of Scientific and Industrial Research and Board of Trade ...	Research in industry.
28. Kinzel, A. B. ...	Ferro-Alloy manufacture and use.
29. Habicht, H. R. ...	German aluminium and magnesium industries, F. I. A. T. Final Report, No. 501.
30. Jensen, Otto ...	German progress on mechanical rectified or contact converter, F. I. A. T. Final Report, No. 515.
31. Gross, Malvern J. ...	Industrial X-Ray field in Germany, F. I. A. T. Final Report, No. 525.
32. Niggli, P. ...	Grundlagen der stereochemie.
33. Niggli, P. ...	Gesteine und minerallagerstätten.
34. Brandenberger, E. ...	Röntgenographisch-analytische chemie.
35. Gombas, P. ...	Theorie und Lösungsmethoden des mehrteilchenproblems der wellenmechanik, Band. 2.
36. Kirk, R. E. & Othmer, D. F. ...	Encyclopedia of chemical technology, vol. 4.
37. Dushman, Saul ...	Scientific foundations of vacuum technique.
38. Wheland, G. W. ...	Advanced organic chemistry.
39. Zworykin, V. K. & Ramberg, E. G. ...	Photoelectricity and its applications.
40. Pincus, Gregory ...	Recent progress in hormone research, vol. 2 & 3.
41. Sumner, H. B. & Somers, G. F. ...	Chemistry and methods of enzymes.
42. Rochow, E. G. ...	An introduction to the chemistry of silicones.
43. Adams, Roger ...	Organic reactions, vol. 5.
44. Daniels, Farrington ...	Outline of physical chemistry.
45. Flory, Paul J. ...	Fundamental principles of condensation polymerization.
46. Bachman, C. H. ...	Techniques in experimental electronics.
47. Fonda, Gorton R. and Seitz, Frederick ...	Preparation and characteristics of solid luminescent materials.
48. Jacobson, C. A. (Edt.) ...	Encyclopedia of chemical reactions, vol. 2.
49. Brown, Thomas B. ...	Foundations of modern physics.
50. Evans, Ralph M. ...	An introduction to color.

Author	Title
51. Boas, W. ...	An introduction to the physics of metals and alloys.
52. Burri, Conrd ...	Das polarisations-mikroskop.
53. Moon, P. B. ...	Artificial Radioactivity.
54. Devons, S. ...	Excited states of nuclei.
55. Miller, A. R. ...	The adsorption of gases on solids.
56. Hoyle, F. ...	Some recent researches in solar physics.
57. Kirk, Paul L. ...	Quantitative ultramicro-analysis.
58. Barnett, Lincoln ...	The Universe and Dr. Einstein.
59. Caldin, E. F. ...	Power and limits of science.
60. Jessop, H. T. & Harris, F. C. ...	Photoelasticity.
61. Pender, H. & Del'Mar, Wm. A. (Edt.) ...	Electrical engineers' hand-book.
62. Winner, Norbert ...	Cybernetics.
63. Niven, Wm. W. (Jr.) ...	Fundamentals of detergency.
64. Gamow, G. ...	Mr. Tompkins explores the atom.
65. Audrieth, L. F. ...	Acids, bases and non-aqueous systems.
66. Luck, J. M. Edt. ...	Annual review of Biochemistry, vol. 19 (1950).
67. Radio Research Committee ...	A symposium on microwaves (1949).
68. ...	Applied Physics Alumni Annual, 1949-50.
69. G. S. I. ...	Records of the Geological survey of India, Vol. 82 (Pt. 1).
70. U. S. Dept. of Commerce National Bureau of Standards ...	Installation and maintenance of electric supply and communication lines safety rules and discussion.
71. Physical Society ...	Reports on progress in physics, vol. 13, 1950.
72. American Society for Testing Materials ...	Index to A. S. T. M. standards.
73. Kuiper, Gerard P. Edt. ...	The atmospheres of the earth and planets.
74. Chemical Society ...	Annual Reports on the Progress of Chemistry, 1949.
75. Ross, Sydney ...	The inhibition of foaming.
76. U. S. Dept. of Commerce National Bureau of Standards ...	Nuclear Data: N. B. S. Circular 499.
77. Butterfield, H. ...	The Origins of modern science.
78. Atlas Powder Co. ...	Atlas surface active agents.
79. Wilkes, M. V. ...	Oscillations of the earth's atmosphere.
80. Elmore, W. C. & Sands, Matthew L. ...	Electronics: Experimental techniques.
81. Gaydon, A. G. ...	Magnetism. Dissociation Energies and spectra of diatomic molecules.
83. Courant, R. and Friedrichs, K. O. ...	Supersonic flow and shock waves.
84. Bothe, Walther and Flugge, Siegfried ...	FIAT review of German Science, 1939-1946. Nuclear physics and cosmic rays, part 1.
85. Govt. of India, Meteorological Department ...	Magnetic, meteorological, atmospheric, electric and seismographic observations.
86. Rodden, Clement J., Edt. ...	Analytical chemistry of the Manhattan project.
87. Poussin, Ch-J. De La Vollee ...	Cours D'Analyse infinitesimale, vols. 1 & 2.
88. Norske Videnskaps Akademi ...	Skrifter, 1941-44.
89. Surugue, J. ...	Techniques Generales du laboratoire de physique, vol. 2.
90. Gaydon, A. G. ...	Spectroscopy and combustion theory.
91. Brooks, B. T. & Dunstan, E. E., Edt. ...	The science of petroleum, Vol. 5, part 1.
92. Marshall, Arthur ...	Explosives, vols. 1, 2, 3.
93. Hopf, L. ...	Introduction to the differential equations of physics.
94. Buttrey, D. N. ...	Cellulose Plastics.
95. Radio Research Laboratory ...	Very high-frequency techniques, Vols. 1, 2.
96. Jahnke, E. & Ende, F. ...	Tables of functions.
97. Gurney, Ronald W. ...	Introduction to statistical mechanics.
98. Guggenheim, E. A. ...	Thermodynamics.
99. Eastman, E. D. & Rollefson, G. K. ...	Physical chemistry.
100. Day, Allan R. ...	Electronic mechanisms of organic reactions.
101. Frey-Wyssling, A. ...	Elektronen Mikroskopie.
102. Soc. Chem. Industry ...	Detergents, wetting and emulsifying agents.
103. Kuehn, M. H. ...	Mathematics for electricians.
104. Kolthoff, I. M. & Lingane, J. J. ...	Polarography, polarographic analysis and voltometry amperometric titrations.
105. Henney, K., ed. ...	Radio engineering handbook.

Author	Title
106. Fraenkel, Adolf ...	Einleitung in die mengenlehre.
107. Goetzel, C. G. ...	Treatise on powder metallurgy.
108. Burk and Grumitt ...	Frontiers in colloid chemistry.
109. ——— ...	Surface chemistry.*
110. Meinzer, O. F. ...	Hydrology.
111. English, J. & Cassidy, H. ...	Principles of organic chemistry.
112. Scott, M. ...	Mechanics: statics and dynamics.
113. Hopkins, A. A., Edt. ...	Scientific American cyclopedia of formulas, vols. 1 & 2.
114. Hiscox, G., Edt. ...	Henley's twentieth century book of formulas, processes and trade secrets.
115. Arnot, F. L. ...	Collision process in gases.
116. Dingle, H. ...	Special theory of relativity.
117. Francis, V. J. ...	Fundamentals of discharge tube circuits.
118. Jaeger, J. C. ...	An Introduction to the Laplace transformation.
119. Lamont, R. L. ...	Wave guides.
120. Owen, David ...	Alternating current measurements.
121. Sas, R. K. & Pidduck, F. B. ...	Metre-kilogram-second system of electrical units.
122. Sutton, O. G. ...	Atmospheric turbulence.
123. Teago, F. J. ...	Commutator motor.
124. White, F. W. G. ...	Electro-magnetic waves.
125. Worsnop, B. L. & Chalklin, F. C. ...	X-rays.
126. Jander, Dr. Gerhart ...	Die chemie in wasserähnlichen losungsmitteln.
127. Williams, W. E. ...	Application of interferometry.
128. Robb, L. A. ...	Engineer's dictionary: Spanish-Eng. & Eng-Spanish.
129. Sanderson, Robert T. ...	Vacuum manipulation of volatile compounds.
130. Northrop, J. H. & others ...	Crystalline enzymes.
131. Lefschetz, S. ...	Introduction to topology.
132. Boltz, D. F., Edt. ...	Modern instrumental analysis, vol. 1.
133. ——— ...	38th Indian Science Congress.
134. Venable, Wm. Mayo ...	Supplement to the interpretation of spectra.
135. Bhatnagar, S. S. & Mathur, K. N. ...	Physical principles and application of magneto-chemistry.
136. Leverenz, H. ...	An introduction to luminescence of solids.
137. Sellars, R. W.; McGill, V. J. & Farber, M., Edt. ...	Philosophy for the future.
138. Carney, T. P. ...	Laboratory fractional distillation.
139. Bridgman, P. W. ...	The physics of high pressure.

B. LIST OF ADDITIONAL JOURNALS SUBSCRIBED TO DURING 1950-51.

1. Angewandte Chemie.
2. Annalen der Chemie.
3. Annalen der Physik.
4. British Abstracts 'C'.
5. Chemie—Ingenieur-Technik.
6. Chemische Berichte.
7. Chemisches Zentralblatt.
8. Journal of Biochemical Society.
9. Journal of Nutrition.
10. Kolloid Zeitschrift.
11. Makromolekulare Chemie.
12. Nachrichten: Biologisch-Physiologisch-Chem-Abt.
13. Nachrichten: Mathematisch-Physikalisch-Chem-Abt.
14. Naturwissenschaften.
15. Physikalische Blätter.
16. Zeitschrift für Anorganische Chemie.
17. Zeitschrift für Elektrochemie und Angewandte Physikalische Chemie.
18. Zeitschrift für Physikalische chemie.

* Papers presented for a Discussion at a joint meeting of the Société de Chemie Physique and the Faraday Society, October, 1947.

C. LIST OF ADDITIONAL JOURNALS RECEIVED IN EXCHANGE DURING 1950-51.

1. Engineering Reports of National Tsing Hua University.
2. Journal of Geophysical Research.
3. Journal of the Institute of Polytechnics.
4. Osaka Mathematical Journal.
6. Philips Technical Review.
7. Revue Trimestrielle Canadienne.
8. Science Report of the Research Institutes, Tohoku University.

D. LIST OF PUBLICATIONS RECEIVED AS COMPLIMENTARY COPIES DURING 1950-51.

1. Abhandlungen der Deutschen Akademie der Wissenschaften Zu Berlin Math-Nat.
2. American Reporter.
3. Annales de L'Acfas.
4. Australian Journal of Agricultural Research.
5. Berichte Uber dei Verhandlungen der Sachsischen Akademie der Wissenschaften Zu Leipzig.
6. Bulletin for Libraries.
7. Das Deutsche Buch.
8. Electronic Measuring.
9. FAO Bulletin.
10. General Radio Experimenter.
11. Half-yearly Journal of Mysore University.
12. Indian Journal of Meteorology & Geophysics.
13. Indian Journal of Physics.
14. Laboratory, The.
15. Manufacturer, The.
16. Sitzungsberichte der Deutschen Akademie der Wissenschaften Zu Berlin Math-Nat.
17. Technical Education News.
18. Technical News Bulletin.
19. To-day (Pictorial).
20. Journal of Calendar Reform, Vol. 20 (1950).

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

BUDGET ESTIMATES : 1951-52

(Excluding Grants for C. S. I. R. Schemes and Development of Research Training Facilities)

RECEIPTS

Heads of Receipts	Actual 1949-50	Original Budget Estimates 1950-51	Revised Budget 1950-51	Budget Estimates 1951-52	Remarks
	Rs.	Rs.	Rs.	Rs.	
I. Government of India—					
1. Grand-in-aid—Recurring	2,56,025	2,66,700	2,66,700	2,66,700	
2. Contribution towards Dearness Allowance to Employees	12,760	13,335	13,335	13,335	(5% of Recurring Grant-in-aid).
II. Other Receipts—					
1. Interest from General Fund	712	495	495	500	
2. Ordinary Membership subscription	870	1,000	1,000	1,000	
3. Life Membership	—	500	750	1,000	(1) Payable to M. L. S. Prof. Fund.
4. Rent	5,573	7,500	7,500	—	
5. Indian Journal of Physics	7,609	6,000	6,000	7,500	
6. Miscellaneous	421	2,000	2,000	2,000	
III. Contribution from M. L. S. Professorship and V. L. M. Funds towards salary etc. of M. L. S. Professor	—	8,420	8,420	8,420	
Total Rs.	2,83,970	3,05,950	3,06,200	3,00,455	
	—	41,359 (2)	41,359 (2)	70,697 (3)	
Grand Total Rs.	2,83,970	3,47,309	3,47,559	3,71,152	

(2) Amount revoted from previous year's Grant.

(3) Deficit for 1951-52. For full details, vide Minutes of the Finance Committee dated 24-2-51, pp. i-iv.

BUDGET ESTIMATES : 1951-52
INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE
BUDGET ESTIMATES : 1951-52

EXPENDITURE

Heads of Expenditure	Actual 1949-50	Original Budget 1950-51	Revised Budget 1950-51	Budget Estimate 1951-52	Remarks	
	Rs.	Rs.	Rs.	Rs.		
I. Establishment—						
1. Salary—						
Dept. of X-rays & Magnetism	24,677 (1)	33,949		33,642	35,568	(1) Excluding the salary D.A. etc. of M. L. S. Prof.
" Optics	29,681	25,879		25,816	26,637	
" Theoretical Physics	—	17,055		6,141	18,240	
" Physical Chemistry	29,597	26,425		26,202	27,672	
" Organic Chemistry	5,303	22,824		20,874	24,031	
" Inorganic Chemistry	—	4,350		1,450	25,440	
Library	4,946	3,327		3,301	3,522	
Workshop	12,366	10,406		9,770	10,892	
Administration	22,158	18,881		17,979	22,357	
	1,28,728 (2)	1,63,096	1,63,096	1,45,175	1,94,359	(2) Including D.A. Rs. 28,462.
2. Dearness Allowance		37,045	37,045	34,826	45,191	
3. Provident Fund Contribution	4,313	12,121 (3)	12,121	11,495 (3)	11,892	(3) Including Rs. 2,870/- re-voted, to be paid to members of staff concerned on confirmation.
4. Contribution towards salary etc. of M. L. S.						
Professor	4,957	—		—	—	
	1,37,998		2,12,262	1,91,496	2,51,442	
II. Laboratory Grants						
<i>Dept. X-rays & Magnetism—</i>						
Recurring	4,666	6,000		8,040	6,000	
Do. (Revoted)	—	2,040		—	—	
Special	13,591	—	8,040	1,000	—	
Do. (Revoted)	—	8,248	8,248	8,248	—	
<i>Dept. of Optics—</i>						
Recurring	5,871	6,000	6,799	6,799	6,000	
Do. (Revoted)	—	799		—	—	
Special	8,983	—		1,000	—	
Do. (Revoted)	—	9,900	9,900	9,900	—	
Carried over Rs.	1,71,109		2,45,249	2,26,483	2,63,442	

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

EXPENDITURE (Contd.).

Heads of Expenditure	Actual 1949-50	Original Budget 1950-51	Revised Budget 1950-51	Budget Estimate 1951-52	Remarks
Brought forward Rs.	Rs. 1,71,109	Rs.	Rs. 2,45,249	Rs. 2,26,483	Rs. 2,63,442
<i>Theoretical Physics—</i>					
Recurring	—	2,000	2,000	1,000	
Special	1,937	—	2,000	4,000	2,000
<i>Physical Chemistry—</i>					
Recurring	5,721	6,000	6,157	6,000	
Do. (Revoted)	—	157	—	—	
Special	14,552	—	6,157	—	
Do. (Revoted)	—	531	531	1,000	
<i>Organic Chemistry—</i>					
Recurring	10,971	6,000	7,414	6,000	
Do. (Revoted)	—	414	—	—	
Special	2,781	—	6,414	5,000	
Do. (Revoted)	—	1,994	1,994	1,994	
<i>Inorganic Chemistry—</i>					
Recurring	—	2,000	2,000	2,000	6,000
Special	—	—	—	6,500	—
III. <i>Library—</i>					
Recurring	5,232	5,000	9,568	—	
Do. (Revoted)	—	4,568	—	9,568	5,000
Special	3,936	3,000	3,965	—	
Do. (Revoted)	—	965	—	1,000	3,000
IV. <i>Workshop—</i>					
Recurring	5,292	5,000	5,257	—	
Do. (Revoted)	—	257	—	5,257	5,000
Special	10,430	2,000	6,669	—	
Do. (Revoted)	—	4,669	—	—	2,000
V. Indian Journal of Physics	15,836	15,313	15,313	15,313	16,848
VI. To corpus of M. L. S. Professor	—	500	500	750	1,000
VII. Laboratory services, general expenses and Miscellaneous etc.	33,883	43,496	43,496	43,496	53,862
Total Rs.	2,81,680	3,49,113	3,49,097	3,71,152	

INDIAN ASSOCIATION

Balance Sheet as at

LIABILITIES	Rs.	As. P.	Rs.	As. P.
<i>General Fund—</i>				
Brought Forward	14,86,418	8 7		
Add Balance transferred from Income and Expenditure Account	24,881	8 0		
Add. Govt. of West Bengal (Non-Recurring) Grant	2,50,000	0 0		
			17,61,300	0 7
<i>Special Funds—(Endowments & Special Receipts)—</i>				
Mahendralal Sircar Professorship Fund	1,49,500	0 0		
Viharilal Mitra Fund	1,00,000	0 0		
Ripon Professorship Fund	25,000	0 0		
Coochbehar Professorship Fund	33,000	0 0		
Hare Professorship Fund	1,500	0 0		
Victoria Professorship Fund	1,500	0 0		
Joykissen Mookherjee Gold Medal Fund	13,400	0 0		
Dr. Bimala Churn Law Gold Medal Fund	7,000	0 0		
Dr. Sircar Research Medal 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		
Less Fluctuation on Investments in G. P. Notes	8,094	2 0		
			3,40,805	14 0
<i>Deposits—</i>				
Rent as per last a/c.	122	0 0		
Library	115	0 0		
			237	0 0
<i>Council of Scientific & Industrial Research—</i>				
X-ray Studies on Metal and Alloys as per last a/c.			54	15 9
<i>Government of India Loan—</i>				
Secured against Building & Land as per last a/c.			5,80,000	0 0
Amount carried over			26,82,397	14 4

FOR THE CULTIVATION OF SCIENCE

31st March, 1951.

ASSETS		Rs.	As. P.	Rs.	As. P.
<i>Land & Building—</i>					
Brought Forward ...	...	...	...	31,680	11 9
<i>Vizianagram Laboratory—</i>					
Brought Forward ...	...	...	39,281	4 0	
Less, Depreciation @ 2%	...	...	785	9 0	
				38,495	11 0
<i>Lecture Hall & Gallery—</i>					
Brought Forward ...	...	...	22,536	2 0	
Less, Depreciation @ 2%	...	...	450	12 0	
				22,085	6 0
<i>Observatory Room—</i>					
Brought Forward ...	...	...	3,189	4 0	
Less, Depreciation @ 2%	...	...	63	12 0	
				3,125	8 0
<i>Range of Shops (East)—</i>					
Brought Forward ...	...	...	2,417	3 0	
Less, Depreciation @ 2%	...	...	48	5 0	
				2,368	14 0
<i>Range of Shops (West)—</i>					
Brought Forward ...	...	...	2,217	0 0	
Less, Depreciation @ 2%	...	...	44	5 0	
				2,172	11 0
<i>Servants' Quarters—</i>					
Brought Forward ...	...	...	983	8 0	
Less, Depreciation @ 2%	...	...	19	9 0	
				963	15 0
<i>Darwans' Quarters—</i>					
Brought Forward ...	...	...	291	5 0	
Less, Depreciation @ 2%	...	...	5	12 0	
				285	9 0
<i>Scientific Instruments & Laboratory Fittings—</i>					
<i>X-Ray & Magnetism Dept.</i>					
Brought Forward ...	1,45,534	1 6			
Less, Deprn. @ 5%	7,276	12 6	1,38,257	5 0	
Add this year ...	...	...	15,689	7 6	
				1,53,946	12 6
Amount carried over ...				2,55,125	2 3

INDIAN ASSOCIATION

Balance Sheet as at

As. P.	Rs.	As. P.	Rs.	As. P.	Rs.
		Brought Forward ...	26,82,397	14	4
Outstanding Liabilities—					
		Audit Fee (49-50) ...	500	0	0
		P. F. Subscription (C.S.I.R.) ...	82	1	0
		Coochbehar Professorship Fund ...	6	9	0
		Payable to Corpus of M. L. S. Professorship Fund ...	1,000	0	0
	22,530	2	0	0	0
	450	12	0	0	0
32,082	0				
		3,189	4	0	0
		63	12	0	0
3,125	8				
		2,417	3	0	0
		48	5	0	0
2,368	14				
		2,217	0	0	0
		44	5	0	0
2,172	11				
		883	8	0	0
		19	9	0	0
903	18				
		281	5	0	0
		5	12	0	0
285	0				
		1,45,534	1	6	0
		7,270	12	6	1,38,257
1,53,016	12				
3,55,122	3				
		Amount carried over...	26,83,986	8	4

FOR THE CULTIVATION OF SCIENCE

31st March, 1951.

ASSETS		Rs.	As. P.	Rs.	As. P.
Brought Forward ...				2,55,125	2 3
<i>Optics Department—</i>					
Brought Forward	... 20,468 14 9				
Less, Deprn. @ 5%	... 1,023 6 9	19,445	8 0		
Add this year	... ..	9,308	4 9		
				28,753	12 9
<i>Physical Chemistry Dept.—</i>					
Brought Forward	... 12,336 14 9				
Less, Deprn. @ 5%	... 616 12 9	11,720	2 0		
Add this year	... ..	5,169	15 9		
				16,890	1 9
<i>Organic Chemistry Dept.—</i>					
Instrument & Fittings	... 9,070 7 6				
Store of Chemical & Glass Apparatus	... 4,681 10 3				
		13,752	1 9		
Less Stores etc. consumed during the year	... 4,681 10 3				
		9,070	7 6		
Less, Deprn. @ 5%	... 453 8 6	8,616	15 0		
Add this year	... ..	3,862	8 0		
				12,479	7 0
<i>Theoretical Physics Dept.—</i>					
Brought Forward	... 1,936 11 6				
Less written off @ 5%	... 38 11 6	1,898	0 0		
Add this year	... ..	1,613	11 9		
				3,511	11 9
<i>Botany Department</i>	... ..			150	0 0
<i>Inorganic Chemistry Dept.—</i>					
Instruments	... 3,325 14 3				
Chemicals	... 528 13 3			3,854	11 6
Amount carried over...				3,20,764	15 0

INDIAN ASSOCIATION OF SCIENCE

Balance Sheet as at

Rs. As. P. Rs. As. P. LIABILITIES Rs. As. P.

Brought Forward ... 26,83,986 8 4

26,83,986 8 4	Brought Forward	26,83,986 8 4	
	Optic Department		
	Brought Forward	20,468 14 0	
	Less Debit @ 5%	1,023 6 0	
	Add this year	2,308 4 0	
20,753 12 0			
	Physical Chemistry Dept.		
	Brought Forward	12,336 14 0	
	Less Debit @ 5%	616 12 0	
	Add this year	5,180 15 0	
18,900 1 0			
	Organic Chemistry Dept.		
	Instrument & Fittings	9,070 7 8	
	Store of Chemical & Glass Apparatus	4,681 10 3	
	Less Stores etc. consumed during the year	4,681 10 3	
		9,070 7 8	
	Less Debit @ 5%	453 8 0	
	Add this year	3,982 2 0	
12,479 7 0			
	Theoretical Physics Dept.		
	Brought Forward	1,998 11 8	
	Less written off @ 5%	98 11 8	
	Add this year	1,613 11 9	
2,511 11 9			
150 0 0			
	Botany Department		
	Inorganic Chemistry Dept.		
	Instrument	2,325 14 2	
	Chemicals	528 19 3	
2,854 11 5			

Amount carried over ... 26,83,986 8 4

FOR THE CULTIVATION OF SCIENCE

31st March, 1951.

ASSETS		Rs.	As. P.	Rs.	As. P.
Brought Forward ...				3,20,764	15 0
<i>Workshop</i>					
Brought Forward	... 48,951 8 6				
Less Deprn. @ 5%	... 2,447 8 6	46,504	0 0		
Add this year	... ..	1,580	8 0		
				48,084	8 0
<i>Tools and Implements</i>					
Brought Forward	... 1,211 12 3				
Less Deprn. @ 5%	... 60 8 3			1,151	4 0
<i>Vehicles</i>					
Brought Forward	... 222 0 0				
Less Deprn. @ 10%	... 22 3 0			199	13 0
<i>Furniture and Fittings</i>					
Brought Forward	... 28,726 14 0				
Less Deprn. @ 10%	... 2,872 10 0	25,854	4 0		
Add this year	... ..	9,158	12 0		
				35,013	0 0
<i>Library</i>					
Brought Forward	... 1,01,018 13 6				
Less Deprn. @ 5%	... 2,020 5 6	98,998	8 0		
Add this year	... ..	14,069	6 3		
				1,13,067	14 3
<i>Tubewell</i>					
Brought Forward	... 1,690 4 6				
Less Deprn. @ 10%	... 169 0 6			1,521	4 0
Amount carried over ...				5,19,802	10 3

INDIAN ASSOCIATION

Balance Sheet as at

LIABILITIES		Rs.	As. P.	Rs.	As. P.
Brought Forward ...				26,83,986	8 4
		48,084	8 0		
		1,580	8 0		
		48,084	8 0		
		1,184	4 0		
		189	13 0		
		32,013	0 0		
		28,128	14 0		
		2,872	10 0		
		0,158	12 0		
		32,013	0 0		
		1,01,018	13 8		
		2,020	2 0		
		14,008	6 3		
		1,13,007	14 3		
		1,000	4 8		
		100	0 0		
		1,521	4 8		
Amount carried over ...				26,83,986	8 4

FOR THE CULTIVATION OF SCIENCE

31st March, 1951.

ASSETS	Rs.	As. P.	Rs.	As. P.
Brought Forward ...			5,19,802	10 3
<i>Investments</i> (in 3% G. P. Notes lodged with Imperial Bank of India) as per last a/c.—				
Mahendralal Sircar Professorship Fund ...	1,49,500	0 0		
Viharilal Mitra Fund ...	1,32,000	0 0		
Ripon Professorship Fund ...	25,000	0 0		
Coochbehar Professorship Fund ...	33,000	0 0		
Hare Professorship Fund ...	1,500	0 0		
Victoria Professorship Fund ...	1,500	0 0		
Joykissen Mookerjee Gold Medal Fund ...	13,400	0 0		
Dr. Bimala Churn Law Gold Medal Fund ...	7,000	0 0		
Dr. Sircar Research Medal 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		
General Fund ...	16,500	0 0		
Building Fund ...	9,500	0 0		
	3,97,400	0 0		
Less Fluctuation on Investments Brought Forward ...	8,444	12 0	3,88,955	4 0
Advance for Construction as per last a/c. ...	1,49,482	5 0		
Addition during the year ...	6,740	0 0		
Others ...	9,429	10 0	1,65,651	15 0
<i>Security Deposit</i> with Calcutta Electric Supply Corpn. ...			1,830	0 0
<i>Land Acquisition & Construction</i> —				
Land Brought Forward ...	4,34,556	11 2		
Construction expenses Brought Forward ...	6,02,465	11 3		
Add Construction this year ...	3,27,745	9 0	13,64,767	15 5
<i>Special Fund</i> —Advances ...			464	10 6
<i>Provident Fund</i> (Excess remittance) ...			8	12 0
Amount carried over ...			24,41,481	3 2

INDIAN ASSOCIATION

Balance Sheet as at

LIABILITIES		Rs.	As. P.	Rs.	As. P.
Brought Forward ...		26,83,986	8 4		
Total Rs. 26,83,986		8 4			

We have to report that we have audited the above Balance Sheet as at 31st March 1951 and the annexed Receipts and Payments Account for the year ending on that date, of the Indian Association for the Cultivation of Science, with the Books of Accounts produced. Subject to our separate report, addressed to the Members, we are of opinion that the said Balance Sheet and the Receipts and Payments Account are drawn up in conformity with law and exhibit a true and correct view of the state of affairs of the Association. In our opinion the books have been kept by the Association as required by law.

1B, Old Post Office Street,
August 14 1951,
Calcutta—1.

Sd./- S. N. MUKHERJI & CO.,
CHARTERED ACCOUNTANTS & AUDITORS.

FOR THE CULTIVATION OF SCIENCE

31st March, 1951.

ASSETS	Rs.	As. P.	Rs.	As. P.
Brought Forward ...			24,41,481	3 2
<i>Contributions Receiveable—</i>				
M. L. S. Prof. Fund ...	4,485	0 0		
V. L. Mitra Fund ...	3,960	0 0		
			8,445	0 0
C. S. I. R. Coal Scheme ...	4,029	1 9		
C. S. I. R. Construction of Osmometer Scheme ...	41	11 9		
			4,070	13 6
<i>Cash Balance—</i>				
Imprest Cash with Departmental Heads ...	750	0 0		
Imperial Bank of India (Current a/c.) ...	2,29,239	7 8		
			2,29,989	7 8
			Total Rs. 26,83,986	8 4

INDIAN ASSOCIATION

Receipts and Payments Accounts for

RECEIPTS	Rs.	As. P.	Rs.	As. P.
<i>To Opening Balances—</i>				
Imprest Cash as per last account ...	750	0 0		
Imperial Bank of India ...	3,49,185	11 8		
			3,49,935	11 8
<i>Government of India—</i>				
Grand-in-aid (Recurring) ...	2,66,000	0 0		
Grand-in-aid (Non-recurring) ...	15,400	0 0		
Contribution towards Dearness Allowance ...	13,300	0 0		
			2,94,700	0 0
<i>Government of West Bengal—</i>				
Grand-in-aid (Non-recurring) ...			2,50,000	0 0
<i>Miscellaneous—</i>				
Interest on Investment (General Fund) ...	495	0 0		
Ordinary Membership Subscription ...	1,290	0 0		
Rent ...	5,444	0 9		
Indian Journal of Physics ...	8,000	10 6		
Life Membership Fees ...	1,000	0 0		
Other Receipts ...	4,001	3 3		
			20,230	14 6
<i>Council of Scientific & Industrial Research—Grants—</i>				
X-Ray investigation on Coal ...	5,478	9 0		
Construction of Osmometer suitable for High Polymer Research ...	4,126	4 0		
			9,604	13 0
Library Deposit ...			75	0 0
<i>Coochbehar Professorship Fund—</i>				
Sale proceeds of Special Publication ...			6	9 0
P. F. subscription—C.S.I.R. (Staff) ...			82	1 0
Amount carried over ...			9,24,635	1 2

FOR THE CULTIVATION OF SCIENCE*the year ended 31st March, 1951.*

PAYMENTS		Rs.	As. P.	Rs.	As. P.
<i>By Establishment—</i>					
Dept. of X-rays & Magnetism	...	38,143	1 0		
„ Optics	...	30,265	5 0		
„ Theoretical Physics	...	5,359	8 0		
„ Physical Chemistry	...	30,964	14 0		
„ Organic Chemistry	...	24,948	2 0		
Library	...	5,335	8 0		
Workshop	...	14,491	6 0		
Administration	...	24,670	2 0		
				1,74,177	14 0
Contribution to Provident Fund	...			8,136	14 0
<i>Laboratory Grants—</i>					
X-rays & Magnetism (Recurring)					
Laboratory charges	...	1,966	15 6		
Scientific Instruments	...	3,845	2 0		
				5,812	1 6
X-rays & Magnetism (Special)					
Laboratory charges	...	2,244	13 0		
Scientific Instruments	...	5,553	3 6		
				7,798	0 6
Optics (Recurring)					
Laboratory charges	...	2,021	6 6		
Scientific Instruments	...	4,368	8 6		
				6,389	15 0
Optics (Special)					
Laboratory charges	...	1,378	6 9		
Scientific Instruments	...	3,913	4 0		
				5,291	10 9
Theoretical Physics					
Scientific Instruments	...			1,613	11 9
Physical Chemistry (Recurring)					
Laboratory charges	...	1,076	2 0		
Scientific Instruments	...	2,992	5 3		
				4,068	7 3
Amount carried over ...				2,13,288	10 9

INDIAN ASSOCIATION OF SCIENCE

Receipts and Payments Accounts for

RECEIPTS		Rs.	As. P.	Rs.	As. P.
Brought Forward ...		9,24,635	1	2	
Administration	24,870	0	0		
Workshop	14,101	6	0		
Library	5,338	8	0		
Organic Chemistry	24,048	8	0		
Physical Chemistry	30,904	14	0		
Theoretical Physics	5,359	8	0		
Optics	30,205	5	0		
Dept. of X-rays & Magnetism	28,143	1	0		
Contribution to Provident Fund		1,74,177	14	0	
Laboratory Grants—					
X-rays & Magnetism (Recurring)	1,980	15	6		
Laboratory charges	3,845	2	0		
Scientific Instruments	5,812	1	6		
X-rays & Magnetism (Special)	2,214	13	8		
Laboratory charges	5,553	3	0		
Scientific Instruments	7,708	0	6		
Optics (Recurring)					
Laboratory charges	2,021	6	8		
Scientific Instruments	4,569	8	6		
Optics (Special)					
Laboratory charges	1,378	6	9		
Scientific Instruments	5,013	4	0		
Theoretical Physics					
Scientific Instruments	1,613	11	9		
Physical Chemistry (Recurring)					
Laboratory charges	1,078	2	0		
Scientific Instruments	2,062	5	3		
Amount carried over ...		9,24,635	1	2	

FOR THE CULTIVATION OF SCIENCE

the year ended 31st March, 1951.

PAYMENTS		Rs.	As. P.	Rs.	As. P.
Brought Forward ...				2,13,288	10 9
Physical Chemistry (Special)					
Laboratory charges ...	...	1,360	5 0		
Scientific Instruments ...	...	120	0 0		
				1,480	5 0
Organic Chemistry (Recurring)—					
Laboratory charges ...	...	6,526	7 9		
Scientific Instruments ...	...	860	12 0		
				7,387	3 9
Organic Chemistry (Special)—					
Laboratory charges ...	...	3,266	11 0		
Scientific Instruments ...	...	3,001	12 0		
				6,268	7 0
Inorganic Chemistry (Recurring)—					
Laboratory Stores (not consumed) ...	...			528	13 3
Inorganic Chemistry (Special)—					
Laboratory Stores (not consumed) ...	...	1,870	10 0		
Scientific Instruments ...	...	1,455	4 3		
				3,325	14 3
Library Grants (Recurring)—					
Books and Periodicals ...	...	6,461	2 9		
Upkeep ...	...	878	12 9		
				7,339	15 6
Library Grants (Special)—					
Books and Periodicals ...	...			7,608	3 6
Workshop Grants (Recurring)—					
Workshop charges ...	...	1,605	1 3		
Instruments ...	...	300	0 0		
				1,905	1 3
Workshop Grants (Special)—					
Workshop charges ...	...	411	0 3		
Instruments ...	...	1,280	8 0		
				1,691	8 3
Indian Journal of Physics—					
Publication Expenses ...	...	8,238	0 9		
Establishment ...	...	6,363	0 0		
				14,601	0 9
Amount carried over ...				2,65,425	3 3

FOR THE CULTIVATION OF SCIENCE*the year ended 31st March, 1951.*

PAYMENTS		Rs.	As. P.	Rs.	As. P.
Brought Forward				2,65,425	3 3
<i>Contribution to Indian Science News Association</i>				1,000	0 0
<i>Miscellaneous—</i>					
Building Repairs	...	661	12 0		
Electric Fittings	...	1,647	13 6		
Gas Charges	...	1,850	13 0		
Electric Charges	...	4,035	4 3		
Telephone	...	313	2 0		
Printing	...	3,146	3 3		
Stationery & Contingency	...	4,527	2 6		
Postage	...	738	2 0		
Advertisement	...	1,309	7 0		
Municipal Tax	...	1,150	0 3		
Science Congress Association (Subscription)	...	12	0 0		
Travelling Allowance for attending meetings	...	1,515	12 0		
Travelling Allowance for attending Science Congress	...	203	1 6		
Bank Charges	...	22	7 0		
Insurance	...	125	0 0		
Meeting Expenses	...	314	3 6		
Miscellaneous	...	1,930	9 6		
				23,502	13 3
<i>Furniture and Fittings</i>	...			9,158	12 0
<i>Construction Expenses</i>	...			3,27,745	9 0
<i>Security Deposit</i>	...			1,800	0 0
<i>Suspense—</i>					
Construction Expenses	...	6,740	0 0		
General	...	5,069	5 3		
Research Endowment Fund	...	464	10 6		
Provident Fund	...	8	12 0		
				12,282	11 9
Amount carried over ...				6,40,915	1 3

INDIAN ASSOCIATION

Receipts and Payments Accounts for

Rs.	As. P.	RECEIPTS	Rs.	As. P.
9,24,635	1 2	Brought Forward	9,24,635	1 2
1,000 0 0		Contribution to Indian Science Association		
601 12 0		Miscellaneous		
1,047 13 0		Building Repairs		
1,850 13 0		Electric fittings		
4,035 4 3		Gas Charges		
313 2 0		Electric Charges		
3,140 3 3		Telephone		
4,527 2 0		Printing		
738 2 0		Stationery & Conveyance		
1,309 7 0		Postage		
1,150 0 3		Advertisement		
12 0 0		Municipal Tax		
12 0 0		Science Congress Association (Subscription)		
1,212 12 0		Travelling Allowance for attending meetings		
203 1 8		Travelling Allowance for attending Science Congress		
22 7 0		Bank Charges		
125 0 0		Insurance		
314 2 0		Meeting Expenses		
1,930 0 0		Miscellaneous		
23,202 13 3		Printing and Fittings		
0,158 12 0		Construction Expenses		
3,27,745 0 0		Security Deposit		
1,800 0 0				
0,740 0 0		Total Rs.	9,24,635	1 2
2,009 2 3				
404 10 8				

This Receipts and Payments Account is referred to in our report on the Balance Sheet.

1B, Old Post Office Street,
August 14, 1951,
Calcutta—1.

Sd./- S. N. MUKHERJI & CO.,
CHARTERED ACCOUNTANTS & AUDITORS.

CONSTRUCTION

STATEMENT OF CAPITAL EXPENDITURES ACCOUNT UPTO MARCH 31, 1951

RECEIPTS			EXPENDITURES		
	Rs.	As. P.		Rs.	As. P.
1. Govt. of India Loan ...	5,00,000	0 0	A. COST OF LAND ACQUISITION ...	4,34,566	11 2
2. Govt. of India Capital Grant ...	4,32,000	0 0	B. CONSTRUCTION EXPENSES		
3. Govt. of West Bengal Capital Grant ...	4,00,000	0 0	1. Foundation stone ...	962	4 9
4. Govt. of India Loan ...	80,000	0 0	2. Fencing with fittings & Store-Room ...	5,244	0 0
5. Govt. of West Bengal Capital Grant ...	1,50,000	0 0	3. M. S. Rods, sheets, etc. ...	20,767	15 0
6. Govt. of West Bengal Capital Grant ...	1,00,000	0 0	4. Cement ...	52,078	5 3
			5. Joists ...	1,02,156	13 9
			6. Iron Posts ...	49,921	12 3
			7. Black Pipes ...	3,939	15 9
			8. G. I. Pipes ...	974	12 0
			9. G. I. Tanks ...	809	15 3
			10. H. C. I. Soil Pipes ...	732	13 0
			11. Sand ...	5,115	0 0
			12. Stone chips & gravel ...	62,721	5 6
			13. Bricks & jhama ...	72,214	5 6
			14. Wooden doors & window frames ...	51,460	3 6
			15. Vehicle ...	23,271	0 9
			16. Electric Fittings ...	9,330	0 0
			17. Tube well ...	35,379	1 0
			18. Tarpaulin ...	2,621	4 0
			19. Water-proofing ...	233	10 3
			20. Wooden posts, planks, etc. ...	1,429	10 6
			21. Wire-netting ...	1,787	9 0
			22. Lime ...	1,433	7 6
			23. Labour ...	4,461	3 6
			24. Establishment ...	83,135	5 9
			25. Remuneration & Labour— M/S. Martin Burn Ltd. ...	20,763	10 3
			26. Remuneration— M/S. Chaudhuri & Guha ...	1,22,792	8 6
			27. Miscellaneous ...	10,000	0 0
			28. Earth ...	9,111	12 6
			29. Steel door & window frames ...	4,596	7 9
			30. Shutterings & scaffoldings ...	22,599	8 0
			31. Porcelain shower ...	26,000	0 0
			32. Advances—	227	7 3
			(a) for cement ...	21,914	1 0
			(b) for transformer ...	12,364	0 0
			(c) for electrical wiring, cable laying, etc. (Edison Power Plant) ...	6,000	0 0
			33. Imprest Cash—		
			(a) M/S. Martin Burn Ltd. ...	10,000	0 0
			(b) M/S. S. K. Chakravarti Ltd. ...	5,000	0 0
			34. Petrol ...	1,088	5 3
			35. Surface drain ...	343	12 0
			36. Labour & Wages— M/S. S. K. Chakravarti Ltd. ...	5,391	9 0
			37. Advances for pipes ...	2,651	12 9
			37A. do ...	740	0 0
			38. Insurance for Motor ...	184	8 0
			39. Pipes & fittings ...	12,692	1 6
			40. Contingency— S. K. Roy Choudhury ...	468	4 9
			41. Remuneration—Martin Burn Ltd ...	10,377	13 0
			42. Repair of van ...	668	4 0
			43. Collapsible gate ...	3,040	12 6
			44. Malthoid ...	4,137	14 0
			45. Hinges, bolts, etc. ...	1,912	14 0
			46. Paints, Powder, etc. ...	831	0 6
Carried over	16,62,000	0 0	Carried over ...	10,08,079	4 3

**STATEMENT OF CAPITAL EXPENDITURES ACCOUNT UPTO
MARCH 31, 1951—Contd.**

RECEIPTS	EXPENDITURE	Rs.	As.	P.
Brought forward	Brought forward	10,08,079	4	3
16,62,000	47. Putty	930	5	6
0	48. Marble	12,613	12	6
0	49. Tank	3,325	0	0
	50. Municipal tax	189	11	3
	51. M. S. Round—flats	2,678	14	6
	52. Licence for culvert	45	0	0
	53. Gasket	106	4	0
	54. Sanitary & fittings	8,951	2	3
	55. Wooden doors & shutters	6,376	3	9
	56. Patent stone	1,016	1	6
	57. Copper plate	126	6	9
	58. Transport	2,788	0	0
	59. Glass pane	6,021	6	9
	60. Subscription	25	0	0
	61. Gibbon Composite	4,694	12	0
	62. Masonite	1,085	10	3
	63. Fabrications	9,374	0	0
	64. Roofings	8,509	0	0
	65. Lock	450	0	0
	66. Advertisement	34	8	0
	67. Water softener	9,013	2	0
	Total construction expenses	10,86,433	9	3
	Security Deposit with Cal. Elec. Supply Corporation	1,800	0	0
	Add Cost of Land Acquisition A.	4,34,556	11	2
	Total Rs.	15,22,790	4	5
	Balance available as on 31-3-51*	1,39,209	11	7

Total Rs. ... 16,62,000 0 0

Grand Total Rs. ... 16,62,000 0 0

* Including cost of land acquisition still due ... 49,723 10 10

