the Medes, B.C. 606. *The Gresham Publishing Company.* —Science in Modern Life, vols. v. and vi., illustrated. *C. Griffin and Co., Ltd.*—Modern Methods of Sewage Disposal, G. B. Kershaw, illustrated; Introduction to the Theory of Statistics, G. U. Yule, with diagrams. *Crosby Lockwood and Son.*—The Valuation of Mineral Properties, T. A. O'Donahue. *Longmans and Co.*—A History of the Cavendish Laboratory, Cambridge. This volume is intended to commemorate the twenty-fifth anniversary of the election of Sir J. J. Thomson to the Cavendish professorship of experimental physics. Among the contributors are the President of Queens' College, Dr. Schuster, W. C. D. Whetham, Dr. R. T. Glazebrook, Sir J. J. Thomson, Prof. H. F. Newall, Norman Campbell, Prof. E. Rutherford, C. T. R. Wilson, and Prof. Wilberforce. The final chapter of the book will be devoted to a bibliography and biography of those who have done research work at the laboratory since its foundation. *Macmillan and Co., Ltd.*—Tennyson as a Student and Poet of Nature, Sir Norman Lockyer, K.C.B., F.R.S., and Winifred L. Lockyer. *Oxford University Press.*—Chinese Pottery and Porcelain, a translation of the Tao Shuo, with introduction, &c., by S. W. Bushell. *G. Routledge and Sons, Ltd.*—Sonnenschein's Best Books, new edition, in three parts. *Swan Sonnenschein and Co., Ltd.*—Hegel's Phenomenology of Mind, translated by J. B. Baillie, 2 vols.; Thought and Things: a Study of the Development and Meaning of Thought or Genetic Logic, Prof. J. M. Baldwin, in 3 vols., vol. iii., Real Logic; Time and Free Will: an Essay on the Immediate Data of Consciousness, Prof. Bergson, translated by F. L. Pogson; Physiological Psychology, Prof. W. Wundt, a translation of the fifth and wholly re-written German edition by Prof. E. B. Titchener, in 3 vols., vol. ii. *Truslove and Hanson, Ltd.*—Oriental Silverwork, H. Ling Roth, illustrated. *The University Tutorial Press, Ltd.*— Hygiene for Training Colleges, Dr. R. A. Lyster.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—The Huxley lecture this year is to be delivered by Prof. Percy Gardner, Lincoln and Merton professor of classical archæology in the University of Oxford.

Mr. Joseph Coates has been appointed to a demonstrator-ship in chemistry, and Mr. R. H. Whitehouse assistant, in the Day Training College for Men.

CAMBRIDGE.—The next combined examination for sixty-seven entrance scholarships and a large number of exhibitions at Pembroke, Gonville and Caius, King's, Jesus, Christ's, St. John's, and Emmanuel Colleges will be held on Tuesday, December 6, and following days. Mathematics, classics, and natural sciences will be the subjects of examination at all the above-mentioned colleges. Most of the colleges allow candidates who intend to study mechanical sciences to compete for scholarships and exhibitions by taking the papers set in mathematics or natural sciences. A candidate for a scholarship or exhibition at any of the seven colleges must not be more than nineteen years of age on October 1, 1910. Forms of application for admission to the examination at the respective colleges may be obtained as follows :—Pembroke College, W. S. Hadley; Gonville and Caius College, the Master; King's College, W. H. Macaulay; Jesus College, A. Gray; Christ's College, Rev. J. W. Cartmell; St. John's College, the Master; Emmanuel College, the Master, from any of whom further information respecting the scholarships and other matters connected with the several colleges may be obtained.

OXFORD.—The University Junior Scientific Club will hold its triennial conversazione on Tuesday, May 24, being the Tuesday in "Eights Week." Members of the club can obtain tickets on application to Mr. N. T. Huxley, Balliol College. The promise of exhibits from members will be gratefully welcomed by Mr. A. F. Coventry, Magdalen College, on behalf of the committee. It is hoped that many old members of the club will take the opportunity of re-visiting the scientific departments of the University.

THE late Mr. E. S. Massey, of Rochdale, among many other bequests, has left 6800l., free of duty, to the University of Manchester. The residue of his property, amounting to about 110,000l., after the bequests are provided for, is left upon trust to be applied for such charitable purposes for the benefit of the inhabitants of Burnley as the Corporation of Burnley shall determine, but so that such purposes be limited to all or one or more of the following objects, and be not by way of reduction of rates :—education, whether mental, physical, technical, or artistic, the advancement of science, learning, music, or other art.

AN effort is being made to found a National Industrial Education League to emphasise the necessity of making elementary education go hand in hand with industrial training. In view of the general consensus of opinion as to the necessity for the formation of such a league, a national conference is to be called at an early date for the purpose of formulating a scheme for carrying out the objects of the league. In addition to the approval of many other associations of workers, no fewer than 88 trades' councils, together representing 334 towns and 299 trades, have given their adhesion, and the London Chamber of Commerce recently passed unanimously the following resolution :—" That the council of the chamber approve, heartily support, and will give all their assistance to the proposed National Industrial Education League." Anyone anxious to take part in the work of the new league should communicate with Mr. R. Applegarth, Central Offices, Craig's Court House, Charing Cross, London.

MR. W. H. LEVER, who was appointed recently chairman of the Liverpool School of Tropical Medicine, in succession to the late Sir Alfred Jones, has made known to the council and professors of the University of Liverpool the particulars of a munificent scheme he has devised to assist the work of the University. He proposes to devote the sum of 91,000l. to the scheme. Arrangements have been made with the owners of the old Bluecoat School for a lease for a number of years. During that period the University can have the option of purchasing the school for a sum, approximately, of 24,000l. Any time when the University exercises that option Mr. Lever will pay the money, and the school will be furnished. If the building is not found suitable, then he will pay 24,000l. for the erection of a building adjoining the University, in which the School of House and Town Planning can be accommodated, and also the School of Architecture. While the University is considering whether the option shall be exercised, Mr. Lever will pay the rent of the school. To provide money for the School of House and Town Planning, the School of Tropical Medicine, and the School of Russian Studies, Mr. Lever proposes to transfer 60,000l. worth of shares in the Bromboro' Port Estate Company to the University. These shares will in future years be a source of great income to the University. While the shares are not paying a dividend, Mr. Lever has arranged for ten years to guarantee 3 per cent. on the 60,000l., which will make 1800l. a year for ten years. With the consent of the University, of this 1800l. a year 800l. will go to the School of Civic Design, 800l. to the School of Tropical Medicine, and 200l. to the School of Russian Studies.

ON Friday last, March 4, the Chancellor of the Exchequer, with whom were Mr. Haldane and Mr. Runciman, received in his private room at the House of Commons a deputation from various universities on the subject of increased financial assistance. A news agency states that the deputation represented all the universities and university colleges in England, excepting Oxford, Cambridge, and Durham. The proceedings were private, but the *Times* gives the following account of the points brought forward by the deputation. It was urged that money is greatly needed for development purposes. The Treasury grants, so far from cutting off local subscriptions, municipal and private, have encouraged them, local people feeling that the institutions are recognised by the Government and regarded as a national concern to which they may well contribute. Every new chair established and every new building put up means extra expense for maintenance, and the deputation urged that, while it is quite possible to get the locality to provide buildings and equipment, it cannot

provide maintenance. Many localities feel they have done all they can, and they also feel they are not merely doing local work, but national and Imperial, indeed, world-wide work. Students are drawn from every part of the Empire and from foreign countries, particularly China and Japan, and they are under no obligation to give their services where they are trained. Any increased grant now given by the nation will be used, not in the fixed and ordinary work of the institutions, but in the highest class of work and in various enterprises that are being kept back for want of funds. The speakers also pointed out that there is under present conditions a certain amount of wasteful-ness, not in money, but in brains and energy, because at their meetings the authorities are generally occupied, not in discussing how best to spend the money and what under-takings will be best for the country, but merely how to economise their funds and how to save 10l. or 50l. Work is lying ready at hand which they are powerless to under-take. Mr. Lloyd George, in the course of a sympathetic reply, told the deputation they could not have come at a worse time. Nothing definite was settled, but a committee has been appointed by the deputation to prepare more detailed information for the Chancellor of the Exchequer as to the financial requirements of the various institutions.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, January 27.—Sir James **Dewar**: Long-period determination of the rate of production of helium from radium. In a previous communication the rate of the production of helium from 70 milligrams of radium chloride was determined by a succession of observa-tions on the growth of pressure measured by a McLeod gauge. These observations extended over a period of about six weeks. It was thought desirable to make an experi-ment to determine the amount of helium resulting from this same sample of radium, after standing in a sealed bulb for an extended period. For this purpose the bulb containing the radium chloride was sealed off at the con-clusion of the above-mentioned experiment of 1908 and kept for nine months. In order to measure the helium thus produced it was necessary to devise a vacuum-tight joint between the sealed radium bulb and a McLeod gauge so constructed that, after thoroughly exhausting the gauge, the drawn-out end of the radium bulb could be broken off, thus allowing the pressure of the accumulated helium in the radium bulb to be rapidly determined. The total volume of the apparatus was 320 c.c. The pressure in the radium bulb when sealed off at the conclusion of first ex-periment was 0·00406 mm., the partial pressure due to this amount of helium would be 0·00008 mm., which must be deducted from the observed pressure to get the true pressure due to the helium produced in the radium bulb during the period in which it remained sealed up; also the pressure in the gauge, before breaking (0·00005 mm.), must also be deducted. This gives a corrected pressure of 0·01613 mm., obtained after heating the salt, due to the helium produced from 70 milligrams of pure radium chloride during a period of 275 days, in a space the total volume of which was 320 c.c. The value of the rate in terms of cubic millimetres of helium per gram of radium per day is thus deduced as 0·463.

March 3.—Sir Archibald Geikie, K.C.B., president, in the chair.—T. G. **Bedford**: The depression of freezing point in very dilute aqueous solutions.—J. **Mercer**: Sturm-Liouville series of normal functions in the theory of integral equations. It is the purpose of this memoir to develop the theory of Sturm-Liouville series of normal functions as a branch of the theory of integral equations. In the first place, two theorems are established relative to the series

$$\psi_1(s)\int_a^b \psi_1(t)\hat{f}(t)dt + \psi_2(s)\int_a^b \psi_2(t)f(t)dt + \cdots$$
$$\cdots + \psi_n(s)\int_a^b \psi_n(t)f(t)dt + \cdots,$$

in which $\psi_1(s)$, $\psi_2(s)$, ..., $\psi_n(s)$, ... are a complete system of normal functions corresponding to a function $(K(s,t))$ of

positive type in the square Q defined by $a \leq s \leq b$, $a \leq t \leq b$: the normal functions are assumed to have such an order that the singular value corresponding to $\psi_n(s)$ does not decrease as n increases: no restriction is placed upon $f(s)$ beyond that it should have a Lebesgue integral in (a, b). Denoting by $K\lambda(s, t)$ the solving function corresponding to $K(s, t)$, the first theorem is to the effect that the upper and lower limits of indeterminacy of the above series include

$$\overline{\underline{\lim_{\lambda \to -\infty}}} - \lambda \int_a^b K\lambda(s, t) f(t) dt$$

between them. According to the second

$$\lim_{\lambda \to -\infty} - \lambda \int_{(q)} K\lambda(s, t) f(s) f(t) \, (ds\, dt)$$

exists and is equal to the sum of the series

$$\left[\int_a^b \psi_1(t) f(t) dt\right]^2 + \left[\int_a^b \psi_2(t) f(t) dt\right]^2 + \cdots$$
$$\cdots + \left[\int_a^b \psi_n(t) f(t) dt\right]^2 + \cdots,$$

when the latter is convergent; whilst the limit is $+\infty$, when the series is divergent. It is then shown that, when $K(s, t)$ is the Green's function of

$$\frac{d^2 u}{ds^2} + q(s) u = 0$$

satisfying a pair of boundary conditions at the end points of $(0, \pi)$, an asymptotic formula for $K\lambda(s, t)$ exists which permits the deduction of important theorems relative to the canonical Sturm-Liouville series

$$\psi_1(s)\int_0^\pi \psi_1(t) f(t) dt + \psi_2(s)\int_0^\pi \psi_2(t) f(t) dt + \cdots$$
$$\cdots + \psi_n(s)\int_0^\pi \psi_n(t) f(t) dt + \cdots$$

The normal functions $\psi_1(s)$, $\psi_2(s)$, ..., $\psi_n(s)$, ... are now solutions of

$$\frac{d^2 u}{ds^2} + (q(s) + \lambda) u = 0,$$

which, for suitable values of λ, satisfy the same pair of boundary conditions as $K(s, t)$; to particular systems of these functions correspond Fourier's sine and cosine series. The results obtained for *any* canonical Sturm-Liouville series are very similar to, but slightly more general than, those for the two *particular* series which are associated with the names of Fejér, Hurwitz, and Lebesgue. The fourth section of the memoir is devoted to an investigation of the convergence of canonical Sturm-Liouville series. In the course of this, it is shown that the convergence of any one of these series at a point of the open interval $(0, \pi)$ involves the convergence of all the other series which corre-spond to the same function $f(s)$. The memoir contains an extension of all results obtained for the canonical to the most general type of Sturm-Liouville series.—A. **Von Antropoff**: The solubility of xenon, krypton, argon, neon, and helium in water.—L. N. G. **Filon**: Measurements of the absolute indices of refraction in strained glass. If light be transmitted through a slab of glass under tension T in a direction perpendicular to the line of stress, it is broken up into two components, polarised in planes per-pendicular and parallel to the line of stress. If μ be the index of refraction of the glass in the unstrained state, then, in the strained state, the indices of refraction corre-sponding to the above two components are $\mu + C_1 T$, $\mu + C_2 T$ respectively. The coefficients C_1, C_2 are spoken of as the stress-optical coefficients for the two rays. The present paper gives an account of measurements of C_1 and C_2 according to a method described by the author in Roy. Soc. Proc., A, vol. lxxix., pp. 440-2. The measurements have been carried out on two Jena glasses bearing cata-logue Nos. O. 935 and VV. 3199 respectively, the first being a borosilicate, the second an "ultra-violet" glass. So far as is known, this is the first series of absolute measurements of C_1 and C_2 extending fairly continuously throughout the spectrum. The only previous measurements are due to Pockel (*Ann. d. Phys.*, 1902), and give the