

so determined that there can be no room for dispute about it, even if it should be removed or perish through age. This is only to be effected by accurate survey work based ultimately on geodetic triangulation, and it is this work carried out by British officers in so many parts of the world, with the aid of modern light and efficient instruments, which is gradually working out the boundaries of nations, and, incidentally, carrying geographical mapping into the remotest regions of the world. The invention of a portable receiver for the transmission of signals by wireless telegraphy is likely to be of the greatest importance to these workers in remote geographical fields. Here again the perfecting of a minor form of installation for wireless telegraphy is rapidly leading to developments of which we are at present only dimly conscious.

What the Society of Arts can do in this special field of activity, after teaching people to believe in science, is to foster by all means in its power such aids to the progress of knowledge as are to be found in new inventions, new developments, and adaptations of instrumental means for observation and measurement in the endless process of collecting information.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Sir Arthur Evans has presented to the museum the last instalment of an interesting set of objects selected from the collections of his father, the late Sir John Evans. The gift consists of 121 specimens ranging in date from prehistoric times to the eighteenth century. The value of the collection is greatly enhanced by the fact that all the specimens composing it were found in Cambridgeshire and the adjacent counties.

Mr. C. S. Wright has been appointed University lecturer in surveying and cartography (Royal Geographical Society lecturer).

Dr. Assheton has been appointed University lecturer in animal embryology.

THE new Gresham College in Basinghall Street, London, E.C., was formally opened by the Lord Mayor on December 15. Mr. Sheriff Painter, chairman of the City side of the Gresham Committee, gave a history of the Gresham Trust, which, he said, came into operation in 1596 after the death of the founder, Sir Thomas Gresham, and his widow. Under Gresham's will seven lectureships were founded in divinity, astronomy, music, geometry, civil law, physic, and rhetoric. For the first 200 years those lectures were delivered at the mansion of Sir Thomas Gresham, in the parish of St. Helen's, Bishopsgate, where Gresham House stood. The first Gresham College was opened in 1843, and the lectures were delivered there until a few years ago, when as it became inadequate to present-day uses, it was demolished and the new building was erected. The building, which is larger than the old college, has a frontage to Gresham Street of about 71 ft. and to Basinghall Street of 58 ft. The lecture hall and gallery will seat about 430 persons. The hall is lined throughout with oak. Provision is made for a complete cinematograph apparatus for use in the scientific and medical lectures. The building has cost about 34,000l.

SPEAKING at the National Liberal Club on the subject of Liberalism and education, Lord Haldane said that when this nation came into existence as a great industrial nation it had practically no competitors. At that time dash and "go" and practical skill alone were required. Now the art of manufacture is linked with the science of education. It is a business which

is controlled by scientific principles, and woe will befall the country which is lacking in the scientific equipment necessary to enable it to compete with its more favoured rivals. In Germany and America great progress is being made in the realisation of the truth that, not only must young men and women be prepared from an early age if they are to be made experts in their vocations in life, but that in their vocational training a large amount of general education must be given. The question will have to be faced in this country, and the only point is whether the public will give to the educational movement that support without which no Chancellor of the Exchequer can make headway. An effort in the direction of higher education is necessary if this nation is to hold its own. Upon the same occasion Mr. J. A. Pease said that the view that education should be made compulsory up to the age of sixteen is an ideal which it is impossible to attain; but he hopes that the present limit may be raised to fourteen years.

ARRANGEMENTS have been made for a large number of educational conferences in London early in the new year. Twenty-one educational associations are co-operating in a conference to be held in the University of London on January 2-10, which will be opened by an address by Mr. James Bryce on "Salient Educational Issues." Among the associations taking part may be mentioned the Geographical Association, of which Dr. J. Scott Keltie is the president, whose address will be, "Thirty Years' Progress in Geographical Education"; the School Nature Study Society; the Association of Science Teachers; the Child Study Society; and the Associations of Teachers in Domestic Subjects and in Technical Institutions. The London County Council has arranged another conference of teachers, to be held at Birkbeck College from January 1 to 3. One of the six meetings is to be devoted to a consideration of the subject of mental fatigue, another to memory drawing, and two others to educational experiments in schools. The Mathematical Association will hold its annual meeting at the London Day Training College on January 7. Among the papers to be read in the morning we notice one by Prof. J. E. A. Steggall on practical mathematics in school. In the afternoon the president of the association, Sir George Greenhill, will give an address on the use of mathematics, and Dr. W. N. Shaw will speak on "Principia Atmospherica."

THE governors of the Imperial College of Science and Technology, at their meeting on Friday last, constituted two new chairs of chemistry, and appointed two new professors—Dr. Jocelyn Field Thorpe, F.R.S., professor of organic chemistry, and Dr. James C. Philip, professor of physical chemistry. Four years ago Dr. Thorpe was elected to the Sorby research fellowship of the Royal Society, which he has held at the University of Sheffield. He was formerly research fellow and lecturer in chemistry at the University of Manchester, and received his earlier training partly in London, at the Royal College of Science, and partly in Germany, where, at Heidelberg, he studied under Victor Meyer and Prof. Auwers. Dr. Philip has been on the staff of the Imperial College for some years latterly as an assistant professor. He is well known for his work on physical chemistry, and is now one of the secretaries of the Chemical Society. He is a graduate of Aberdeen and Göttingen Universities. The department of chemistry in the Imperial College has now four professors—Prof. H. Brereton Baker, F.R.S., who is professor of chemistry and director of the laboratories; Prof. W. A. Bone, F.R.S., professor of chemical technology (fuel and refractory materials), together

with the two new professors. At present there are 117 students working specially at chemistry, including its technological applications, of which number thirty-six are engaged in research. In addition, the department provides the subsidiary training in chemistry for about 329 other students.

THE annual prize distribution of the Sir John Cass Technical Institute was held on Wednesday, December 10, when the prizes were distributed by Sir Thomas H. Elliott, K.C.B., Deputy Master and Comptroller of the Royal Mint. The chair was taken by Sir Owen Roberts, chairman of the governing body of the institute. Sir Thomas Elliott, in addressing the students, spoke of the desirability of keeping in view the aim of the instruction provided at the institute, the object of its work, and the extent to which this object was being accomplished. He was himself disposed to say that the primary purpose for which the institute exists is to assist students to do justice to themselves and to those who may be or become dependent upon them, to enable them to perform services which the community requires and for which the community is prepared to pay, and to pay well, to increase their earning powers, and so to help them to secure a better livelihood for themselves than would otherwise be theirs. He counselled the students not to be afraid of selecting a manual occupation and in connection with it to endeavour to learn all the facts connected with the material used, the machinery employed, and the scientific principles upon which the work is based. The Rev. J. F. Marr, chairman of the institute committee, gave a summary account of the work of the institute during the past session, in which he referred especially to the increasing number of students, the research work that had been carried on in the institute, both by students and by members of the staff, and the several developments in the courses of instruction provided. In the latter connection details were given of the work on colloids, on the theory and applications of mathematical statistics, on the fermentation industries, on mine sampling and valuing, on metals used in the motor-car industry, and on the casting of metals, all subjects which had received the special attention of the governing body during the past session.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, November 28.—Prof. C. H. Lees, F.R.S., vice-president, in the chair.—Prof. H. L. Callendar: The expansion of silica. In attempting to deduce the expansion of mercury by the weight thermometer method with silica bulbs it was necessary to determine the expansion of specimens of silica from the same source as the bulbs, and to extend the observations of expansion over the range 0° C. to 300° C. Specimens which had been exposed to high temperatures appeared to give lower results over the range 0° C. to 300° C. than specimens which had not been heated above 300° C. during the measurements. Specimens of the same material, (1) in the form of rods were obtained and were heated and tested by the Newton ring method over the range 0° C. to 300° C.; and (2) in the form of tubes, which were tested by the Fizeau method over the range -20° C. to 150° C. The difference between the axial and radial coefficients of the tube specimens had also been tested. The expansion of the silica rod gave results agreeing with the extrapolation of the curve representing the original observations between 300° C. and 1000° C. The silica rods showed at first some peculiarities due to intrinsic strain, but settled down into a cyclic state which could be repre-

sented over the range 0° C. to 300° C. by the formula $10^8 \times \text{mean coefficient } \alpha^{\circ} \text{ to } t = 78.0 - 8650/(t + 175)$, but the variation of the coefficient with temperature was rapid and peculiar over this range and could not be represented by a formula of the usual type. The axial expansion of four different specimens had been measured, and could be represented between -20° C. and 150° C., with a little divergence by the formula, $10^8 \times \text{mean coefficient } \alpha^{\circ} \text{ to } t = 29.0 + 0.250t - 0.00070t^2$, which agreed over this range with the formula found for the rods, but was inadmissible for extrapolation to 300° C. The difference between the radial and axial coefficients was tested. Differences of the order of 5 or 10 per cent. in the expansion in different directions appeared to be persistent, and were not removed by heating the specimens to 1000° C. or cooling in liquid air. It was concluded that the differences in the radial coefficient might be due to distortion of the ring. It was considered that the most probable result for the cubical coefficient would be obtained by assuming it to be three times the linear. Owing to the smallness of the expansion of silica, and its comparative freedom from hysteresis, the possible uncertainty with the silica bulbs was probably less than 1 in 1000, in spite of the imperfect annealing.—F. J. Harlow: The thermal expansions of mercury and fused silica. A more complete set of observations of the relative coefficients of expansion of mercury in silica than those previously published are obtained by the use of an electrically heated oil bath. The observations comprise readings at frequent intervals up to 300° C., and are in good agreement with the earlier observations. Tables are included giving representative observations and the final results. From the values of the coefficients of expansion of silica determined by Prof. Callendar, the coefficients of absolute expansion of mercury are calculated.—Prof. J. A. Fleming: An experimental method for the production of vibrations on strings. An apparatus for the production of vibrations of strings loaded or unloaded was shown. The vibrations are produced on a string by attaching one end to the shaft of a small continuous-current motor of about $\frac{1}{2}$ h.p. The other end of the string is attached to a fixed point which can be moved by means of a screw, in some cases a spring balance being interposed to measure the tension. When the motor is started the string has a circular motion given to its end which is equivalent to two simple harmonic motions at right angles to each other. If the tension is adjusted rightly the string then vibrates in sections, and the number of sections can be adjusted. The distance from node to node can then be measured easily, and the frequency determined from the speed of the motor. In this way the velocity of the wave is measured, and can be compared with the velocity determined by taking the square root of the quotient of the tension by the linear density of the string. This method is useful in studying the properties of loaded strings. When the wave-length on the string extends over a distance of more than eight or ten loads, the string vibrates as if the loading matter were distributed uniformly, but the string cannot propagate vibrations when the half wave-length approaches equality to the distance between two loads. It is possible to show the reflection of a wave at a load placed at any point on the string, and also that this reflection is reduced by tapering off the loading. With this loaded vibrating string all the phenomena of inductive loading in telephone cables on the Pupin system can be imitated.

Geological Society, December 3.—Dr. Aubrey Strahan, F.R.S., president, in the chair.—Dr. E. A. Newell Arber: A contribution to our knowledge of the geology of the Kent Coalfield. An account of the