very small, and then quickly drawing them out whilst soft. Finally, we may add that tubes of silica can as readily be sealed to one another as tubes of glass, and that T-pieces and side tubes generally may be formed by fixing rings of silica in the positions to be occupied by the side tubes and extending them by blowing as already described, or by attaching tubes of suitable dimensions, previously prepared, to short side tubes blown as just described. It is therefore possible to construct such apparatus as Geissler tubes, small distilling tubes, and thermometers with stems of the German type, &c. We feel sure that small flasks could easily be made also by means of suitable combinations of several oxy-gas burners, though doubtless they would be rather expensive.

Finally, solid rods of silica five or six millimetres in diameter can be made by putting together small masses of prepared silica, or better by pressing together in the flame the softened ends of the fine rods already described.

Notes on some Properties of Vitreous Silica.[1]—A good many of the properties of silica have already been described by Prof. Boys, but a knowledge of the following, some of which are, we think, now described for the first time, will be found useful :—

(1) Vitreous silica is a very poor conductor of heat; hence it is possible to hold a thick rod of silica very close to a strongly ignited zone.

(2) Our colleague, the Rev. H. Pentecost, finds that vitreous silica is less hard than chalcedony, but harder than felspar. Its surface appears to be about equally hard after it has been heated as strongly as possible and cooled suddenly, and after it has been heated and cooled in the air. Tubes of silica may be readily cut by means of a cutting diamond, and also with a good file of hardened steel.

(3) It has already been stated that cold vitreous silica can be plunged safely into the hottest part of an oxy-gas flame, and that the heating and cooling process can be repeated with impunity. Hot vitreous silica bears sudden cooling equally well. We have repeatedly plunged thick rods and large tubes of silica, heated till plastic, into cold water and even into fusible metal below 100°, without any injury to the material, for when afterwards cut with a diamond it did not fly.[2]

On the other hand, threads of silica become rotten when heated to the highest temperature of an ordinary blowpipe.[3] Large objects seem to be affected to a much less degree; and we suspect that this phenomenon may be due to surface devitrification. When silica is in this friable state it can be re-annealed by again softening it in the oxy-gas flame. According to Gaudin, wires of silica heated to a suitable temperature ("rouge-blanc") acquire great cohesion and become very elastic.

We have not yet succeeded in fixing platinum electrodes securely into silica tubes. But we have reason to hope that this may be found to be practicable by the use of kaolin, or some other natural silicate. Meanwhile, it seems possible that they might be soldered into the silica if necessary (see "Laboratory Arts," by R. Threlfall).

We may add that, according to M. Gaudin, emerald gives threads which are even more tenacious than those of silica.

W. A. SHENSTONE.
Clifton College. H. G. LACELL.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The following is the Speech delivered, on April 26, by the Public Orator (Dr. Sandys) in presenting Mr. CHARLES HOSE for the degree of Doctor in Science, *honoris causa*.

Insulam Borneonem orbis terrarum inter insulas omnes prope maximam esse constat. Insulae autem illius insulis nostris fere duplo maioris in parte septentrionali patet regio quae unum e Britannis regem suum esse gloriatur. In eadem vero regione provincia quaedam, fluviorum ingentium infra confluentes, abhinc annos decem alumno nostro tradita est, qui barbarorum animos bellicosos pacis ad foedera vocavit, et armorum certamina saeva certaminis nautici in ludum mutavit. Idem non modo in foedere inter barbaros sanciendo victimarum caesarum haruspex sollertissimus, sed etiam avium in silvis volantium augur et auspex admirabilis exstitit. Ergo alumni nostri auspiciis et Helvetiae et Bataviae et Germaniae et Galliae et Britanniae musea avium et animalium exemplis eximiis aucta et suppleta sunt, et insulae ipsius zoologia, anthropologia, geographia, novo lumine illustratae. Talia propter merita alumnus noster non modo inter nosmet ipsos a regia geographiae societate praemio singulari donatus est, sed etiam inter Europae gentes tum aliis honoribus ornatus est, tum praesertim inter Germanos falconis albi eques iure optimo nominatus est. Nostra denique zoologiae, anatomiae, archaeologiae musea iam plus quam decimum per annum alumni nostri liberalitatem loquuntur. Ergo nos quoque insulae tantae non modo avium et animalium venatorem assiduum, sed etiam montium et fluminum exploratorem intrepidum, ob scientiarum fines etiam imperii Britannici prope terminos feliciter propagatos, laurea nostra hodie libenter coronamus.

Duco ad vos museorum nostrorum patronum liberalissimum, exploratorum nostrorum hospitem benignissimum, CAROLUM HOSE.

The General Board propose the establishment of a lectureship in ethnology, to which Dr. Haddon may be appointed; and a lectureship in bacteriology and preventive medicine for Dr. Nuttall. Both have unofficially given valuable instruction in their respective subjects, and the recognition now suggested will probably be readily accorded by the University. New lectureships in experimental physics and in agricultural chemistry are also proposed.

The Board of Agricultural Studies, at the close of their first financial year, make a highly satisfactory report. Their income is sufficient for the provision of a complete course of instruction, which has now been organised under the direction of Prof. Somerville. They now ask the University to establish a special examination in agricultural science (botany, chemistry, physics and geology) for the ordinary B.A. degree.

THE history of the University of London, from the time of Sir Thomas Gresham's bequest, in 1575, of his house and garden in Bishopsgate, for the purposes of education, down to the completion of the work of the commissioners appointed under the University of London Act, 1898, is traced in an interesting article in the current number of the *Quarterly Review*. The large part the University has taken in the renascence of natural science, which will hereafter be regarded as the main characteristic of intellectual progress in the nineteenth century, is pointed out, as well as the fact that London degrees in science were the first conferred by British universities.

WE learn from *Science* that the University of Chicago has secured the 2,000,000 dollars needed to meet the requirements of Mr. Rockefeller's gift of an equal amount. At the recent convocation of the University, President Harper gave some details in regard to the gifts received since January 1st. They have come from more than 200 different persons, and 90 per cent. of them were unsolicited. The largest items appear to be the Gurley palæontological collection, 30,000 dollars from Mrs. Delia Gallup, and, given anonymously, 60,000 dollars for a commons, 50,000 dollars and 25,000 dollars for a students' club-house, 20,000 dollars towards a women's hall, and 30,000 dollars with specific use to be designated later. President Harper stated that the total assets of the University are now not far from 11,000,000 dollars.

THE Technical Education Board of the London County Council will proceed shortly to award five senior county scholarships, each of the value of 60*l*. a year for three years, with free tuition fees up to 30*l*. a year. These scholarships are intended to assist young men and women to pursue a course at some University or at a technical college of University rank. Some of the scholars who have been elected in previous years are holding their scholarships at Oxford and Cambridge, others are studying at technical colleges in different parts of England, while others are pursuing courses of study on the Continent. The scholarships are open only to candidates who are under twenty-two years of age, and whose parents are in receipt of not more than 400*l*. a year. In addition to the senior scholarships, the board has in past years made a certain number of grants of smaller value to assist students in pursuing advanced education, and the board has at its disposal a certain number of free places at University College, London, King's College, London, and Bedford College, London. The scholarships and grants are awarded, not on the result of a set examination, but on the consideration of the past achievements and promise of

[1] See also Gaudin, *loc. cit.*
[2] Gaudin obtained similar results with drops of *liquid* silica.
[3] Gaudin observed a similar phenomenon in the case of fine threads, and so also, we believe, did Boys.

the candidates. Application forms may be obtained from the secretary of the Technical Education Board, 116, St. Martin's Place, W.C., to whom they should be returned not later than May 14. The board is also offering scholarships for the encouragement of horticulture and gardening. Two of these, tenable at the Swanley Horticultural College, Kent, give free board and tuition for two years, and may be reckoned as of the value of 60*l.* a year. They are open to candidates between the ages of sixteen and twenty, and one will be awarded to a young man and the other to a young woman as the result of a competitive examination. No candidate is eligible whose parents are in receipt of more than 400*l.* a year.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society.—Ordinary meeting held by the invitation of Sir Norman Lockyer, F.R.S., in the Solar Physics Observatory, South Kensington, on April 27.—Mr. T. H. Blakesley, Vice-President, in the chair.—Sir Norman Lockyer gave a short account of the physical problems now being investigated at the Solar Physics Observatory, and their astronomical applications. The chief work carried on at the observatory is the comparison of stellar spectra with spectra obtained from lights emitted by laboratory sources. The light from a star (or the sun) and from an arc (or a spark) are focussed alternately upon the slit of a spectroscope, and the two spectra are photographed side by side upon the same plate. The number of lines in the arc spectrum depends upon which part of the arc is focussed on the slit. The image of the centre is rich in lines, the image of the edge gives a few single lines. Changes in spectra are also dealt with. The thickening and thinning of lines depends upon several things. In the first place, it depends upon the density of the substance, and thus the hydrogen lines in the spectrum of Sirius are much broader than those in α Cygni, the hydrogen being denser in the former star. Changes may also be produced by variations in quantity. A reduction in the quantity of a substance generally simplifies its spectrum, the longest line disappearing last. The motion of a luminous body to or from the spectroscope alters the wave-length of the light emitted and produces a shift in the lines of the spectrum. The amount of deviation is a measure of the velocity in the line of sight. In the case of Nova Aurigæ, we have dark and bright lines of the same substance side by side. This shows that there are two bodies involved, moving with different velocities, the one giving a radiation and the other an absorption spectrum. Another change in the lines depends upon temperature. In general an increase in temperature produces a greater number of lines, a notable exception being sodium, which gives its full number of lines at the temperature of an ordinary Bunsen flame. The spectra of metals obtained from the arc, and by sparking, are often quite different. Those lines which make their appearance, or are intensified in passing from the arc to the higher temperature of the spark, are known as enhanced lines. The comparison of stellar spectra with laboratory spectra is often easy. For instance, the presence of iron in the sun and hydrogen in Sirius is easily seen. Several lines in the spectrum of Bellatrix have been shown to be due to helium, the position of the lines being exactly the same as those due to the gases from clevite. In many cases it is possible to build up the spectrum of a star from the spectra of its constituents taken at the proper temperatures. For instance, the spectrum of γ Orionis can be closely imitated by means of oxygen, nitrogen, and carbon together with the well-marked lines of hydrogen and helium. We can roughly estimate by the character of the spectra of stars, the temperatures of those stars, and thus arrive at a stellar thermometry. Starting with a hot star like Bellatrix, and passing through β Persei, γ Lyræ, Sirius, Castor, Procyon to Arcturus, a cold star, we have a gradual change in the character of the lines which appear in the spectrum of any constituent. The widening of the lines in the case of spectra of sun spots enables us to trace changes in temperature of the sun, and we can compare these temperature changes with a variety of terrestrial phenomena, such as variation in latitude. The extraordinary number of lines exhibited by many metals suggests that what we are accustomed to call chemical elements are really complex bodies which are made up of simpler ones. Attempts have been made to build up the spectra of metals by superimposing simple sets of lines upon one another. In many cases a great number of series would be required to represent things completely. In the case of hydrogen it would be necessary to have at least twenty-seven series to give the structure spectrum only Taking the atomic weight of hydrogen as unity, the atomic weight of the little masses which might give rise to any one of these series would be about 0019. This is of the order of magnitude of the small bodies, of which the existence has been suggested by Prof. J. J. Thomson from his work on ions.

PARIS.

Academy of Sciences.—M. Maurice Lévy in the chair.—The President announced to the Academy the death of M. Alphonse Milne-Edwards, and gave an account of his work.—On linear partial differential equations of the second order, and on the generalisation of the problem of Dirichlet, by M. Emile Picard.—On the heats of combustion and formation of some iodine compounds, by M. Berthelot. A redetermination of the heats of combustion of fourteen typical iodine derivatives. In spite of preconceived notions to the contrary derived from the incomplete combustion of such compounds as iodoform in air, no difficulty was experienced in completely burning any of the substances in the calorimetric bomb.—On rifling in cannon, by M. Vallier. A discussion on the best form of curve for the rifling of cannon, and an extension of the work of M. Zaboudski upon the same subject.—On the upright trunks, stems and roots of Sigillaria, by M. Grand'Eury. A study of the Sigillaria existing in a quarry in the neighbourhood of St. Étienne. From the fact that the stems (*Syringodendron*) found in a vertical position are not distributed at random, but are usually found in groups near each other forming well marked colonies, and from other characters of their growth, the author concludes that the hypothesis of R. P. Schmitt that they have been transported by water and deposited in the position found, is untenable. The view of Dawson that they have grown upon unsubmerged soil is also held to be untenable, all the facts noted by the author pointing to the Sigillaria have grown in the place in which they are found in marshy soil; under water varying from 1 metre to 7 or 8 metres in exceptional cases.—Reply to a reclamation of priority of M. Curie, by M. Gustave le Bon.—Reply by M. Th. Tommasina to a reclamation of priority, by MM. Ducretet and Popof.—Note by M. L. M. Bullier replying to M. Geelmuyden on a question of priority.—On the complementary terms in the criterium of Tisserand, by M. Gruey.—On differential equations of any order whatever with fixed critical points, by M. Paul Painlevé.—On the generalisation of analytical prolongation, by M. Émile Borel.—The theoretical cycle of gas engines, by M. A. Witz. A discussion of the remarks and criticism of M. Marchis.—On the dielectric constant and the dispersion of ice for electromagnetic radiations, by M. C. Gutton. The value of the refractive index for electromagnetic waves was found to vary with the wave-length from 1·76 for a wave-length of 14 cm. to 1·50 for 2088 cm., ice thus presenting normal dispersion for electromagnetic waves.—Two applications of Govi's camera lucida, by M. A. Lafay.—On the maximum sensitiveness practically employed in coherers for wireless telegraphy, by MM. A. Blondel and G. Dobkevitch. The increase of sensibility observed by M. Tissot to occur when the coherer is placed in a magnetic field, is ascribed by the authors to purely mechanical causes, the increase of contact between the powder and the electrodes produced by their mutual attraction.—On the radiations of radium, by M. E. Dorn. The author draws attention to the fact that he published a note on the deviation of the rays emitted by radio-active barium bromide in an electric field on March 11, independently of M. Becquerel.—On a new thermo-calorimeter, by M. G. Massol. Two improvements on Regnault's thermo-calorimeter are suggested, the replacement of alcohol by sulphuric acid, giving a large increase in the range of the instrument, and the use of a reservoir at the upper end of the instrument as in Walferdin's maximum thermometer by which the sensitiveness of the thermo-calorimeter is increased without undue lengthening of the stem. The instrument thus modified has been of especial service in the study of superfused liquids.—A new indicator in acidimetry, and its application to the estimation of boric acid, by M. Jules Wolff. The indicator proposed is a solution of ferric salicylate in sodium salicylate, which passes from violet to orange when the solutions become alkaline. Data are given showing the results obtainable with borates.—On the selenides and chloroselenides of lead, by M. Fonzes-Diacon.—Crystallised lead selenide, PbSe, is obtained by