it congeals, forming blocks of the size and shape of an ordinary building brick. These, after being trimmed to remove adherent oxide, are immersed in paraffin oil, and are then packed into large iron drums holding about 6 cwt. or 7 cwt., capable of being closed air-tight, and protected in transit by an outer casing of wood.

The due regulation of the volume and intensity of the current is a matter of the greatest importance in order to obtain the most economical yield of the metal. No very high temperature is needed; indeed, the temperature of the fused caustic soda should not be much higher than that of its melting point. By suitably regulating the current, the soda, in fact, may be maintained at the proper temperature and in the proper degree of fluidity without extraneous heat. Fresh melted caustic soda is added to the vessel from time to time to replace the metal removed, and in this manner the process is made continuous.

The Castner process is now worked in England at Wallsend-on-Tyne, and at Weston Point, in Cheshire; at Rheinfelden, in Germany; at Clavaux, in France; also in Switzerland, and at Niagara, in America. The present yearly output amounts to about 5000 tons, but the plant already laid down is capable of producing at least twice this quantity.

The greater quantity of the sodium made in England is sent to Glasgow, where it is converted into sodium cyanide by the Cassel Cyanide Company for use in the extraction of gold. As gold is, I suppose, generally considered the principal material factor in procuring the comforts and conveniences of life, Davy's great discovery may be thus said to have secured the primary object which the projectors of the Royal Institution had in view. Other important uses of sodium are in the manufacture of peroxide for bleaching purposes, of artificial indigo, and of a number of other synthetic dye-stuffs and of drugs like antipyrin.

It need hardly be said that this extraordinary development of the manufacture has not been without its influence on the price of sodium. A quarter of a century ago it was a comparatively rare metal, and a stick of it was regarded as a chemical curiosity, to be handled with circumspection and care. Even as late as 1890 its selling price was as high as 8*s*. per lb. To-day it is 8*d*. Sodium now takes rank, therefore, with zinc, tin, copper, or aluminium as a common, ordinary metal of commerce.

I am indebted to the directors of the Castner-Kellner Company, and in particular to my friends Sir Henry Roscoe and Mr. Beilby, for affording me the opportunity, in connection with this lecture, of actually witnessing the modern process of manufacturing sodium as it is carried out at Wallsend, and I am further indebted to Mr. Beilby for the loan of the lantern-slides and specimens with which I have sought to illustrate that process.

And in concluding may I be permitted to recall here the feelings to which that visit to Wallsend gave rise? There, grouped together on the very spot where ended the old wall—the visible symbol of the power and might of a civilisation long since passed away—were some of the characteristic signs of another civilisation ampler and more beneficent. Before me, stretching down to the river, was the factory where a score of workers, clad in helmets and gauntlets, and swathed like so many Knights Templar, their visages lit up by the yellow soda flames, and their ears half-deafened with the sound of exploding hydrogen—a veritable inferno—were repeating on a Gargantuan scale the little experiment first made a century ago in the cellars of this building, turning out, day and night, tons of the plastic metal in place of the little pin-heads which then burst upon the astonished and delighted gaze of Davy. Behind me was the magnificent power-house—one of the most magnificent of its kind in the world—furnishing not only the electrical energy which transformed the soda into sodium, but diffusing this energy for a multitude of other purposes over an entire district—a noble temple to the genius and prescience of Faraday. Surely one might here say, if you desire to see the monuments of these men, look around! And to my right, and close at hand, was the huge building slip just vacated by the *Mauretania*, herself a symbol of the supremacy of an empire, far mightier, more world-wide, and more potent for good than that which massed its legions behind the old wall.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The electors to the Allen scholarship give notice that they are prepared to receive applications from candidates. Any graduate of the University is eligible for the scholarship provided that his age on the first day of the Lent term 1908 does not exceed twenty-eight years. This year the scholarship is open to candidates who propose to undertake research in any branch of study which comes within the department of any of the following special boards:—medicine, mathematics, physics and chemistry, biology and geology. The scholarship is tenable for one year, during which period it will be the duty of the student to devote himself to research in Cambridge or elsewhere. The emolument of the student is 250*l*., or such smaller sum as the fund, after payment of all expenses, shall be capable of providing. Every candidate must send particulars of his qualifications, &c., to the Vice-Chancellor, Gonville and Caius College Lodge, on or before February 15.

MANCHESTER.—The following brief summary of some recently published statistics serves to illustrate the development in the work of the University during the past eight years. The table not only indicates that a considerable increase has taken place in the numbers of students and staff, but also shows that the progress has been particularly marked in the fields of advanced study and research. The growing success of the honours schools in both science and arts is particularly worthy of notice:—

	End of 1899	End of 1907
Professors	30 ...	43
Total teaching staff...	98 ...	203
Students taking full day courses...	900 ...	1400
Science honours students	97 ...	180
Arts honours students	34 ...	106
Graduate and research students in residence	— ...	141
Research fellows and students pursuing original work	— ...	55

By the will of the late Mr. Basil McCrea, the Magee Presbyterian College, Londonderry, receives several substantial benefactions. Among these gifts occur 14,000*l*. for building and equipping a new lecture hall; a sum to endow two professorships, to be known respectively as the "Henry Wallace" and the "William Archer Butler" professorships, each professor to receive an annual stipend of 300*l*.; a sum to found and endow two lectureships in the science department of the college, each lecturer to receive an annual stipend of 150*l*., and to be known as the "McCrea lecturers"; such annual sum as may be necessary to make up the stipends of each of the professorships in the literary and science departments to 300*l*. per annum; 500*l*. each year to found and endow a "McCrea science scholarship" and a "McCrea literary scholarship," each of the value of 100*l*., to be competed for every third year, and any surplus to be used for "McCrea prizes" in the science and literary departments.

AT a recent meeting of the governors of the Glasgow and West of Scotland Technical College it was intimated that the Glasgow City Educational Endowments Board had made a further grant of 1000*l*. to the building fund of the college, and that the trustees of the Bellahouston Bequest Fund had promised a donation of 5000*l*. on condition that the governors raised a further sum of 45,000*l*. Including these grants, the building fund now amounts to 301,000*l*. The governors of the college have just resolved to raise the standard of the preliminary examination for admission to the course for the college diploma to that of the Leaving Certificate of the Scotch Education Department. The holders of this certificate are exempted from the preliminary examination of the Scottish universities. This raising of the standard of the entrance examination by the governors of the great technical college at Glasgow represents a new departure of high significance in technical education. Now that the courses will be based upon a preparatory training equal to that demanded by any British university, it will be possible to make substantial advance in the quality of the work undertaken.

A SCHEME to prepare girls better to undertake the duties of the home was described in a letter to the *Times* of January 24. The communication was signed by Prof. William Osler, F.R.S., Sir Henry Roscoe, F.R.S., and Prof. A. Smithells, F.R.S., with others. Instruction of the kind required is impossible without teachers capable of giving it, and the first step must be, the letter points out, to provide education of an advanced type for those who will hereafter conduct the work in its more elementary stages. It is therefore proposed to provide in London a course of post-graduate instruction in household economics. The course will be given at the women's department of King's College, and will begin next October. A college board, consisting mainly of the professors of the subjects germane to the course, with Prof. Smithells acting as honorary adviser, will control the educational side of the work. It is hoped that it will be found possible to include courses of training for the management of large educational and other institutions, for the duties of factory inspection, and for social work aimed at raising the standard of home life. Donations are asked for in order to raise 3000*l*., the sum necessary for the effective organisation of the scheme, and may be sent to Miss Soltau, King's College (Women's Department), 13 Kensington Square, W.

THE best results are obtained in those technical schools where the students are encouraged to follow a suitable course of training extending over a number of years, and where the instruction provided is suited exactly to the industrial requirements of the district. The latest report of the Board of Education states in this connection:—"Well-considered programmes of instruction within schools and careful adjustment of the relation of school to school in populous areas have become more common. In an increased number of schools we find teachers at pains to urge continuity of study and to order their teaching so as to help towards this end. Opportunities for advanced work are provided more widely than before, and accordingly we find the period of study extending and the number of students of mature years increasing." To mark still more obviously the importance of continuity of study, the Board has given prominence to an arrangement by which the Board and the school authorities join in responsibility for the issue of "technical course certificates" affording suitable records of completed curricula. These certificates are to be given only in connection with courses each approved as providing such a technical education as will have a definite value in relation to the occupation to which it has regard. Each certificate as awarded by the local education authority or the managers of a school and endorsed by the Board will record continued attendance and satisfactory attainments in the several sections of the specified course of instruction. The system thus initiated appears to be capable of considerable development. It may become a valuable feature in the organisation of technical courses—standardising their aims and encouraging the students to persistent attendance and continuity of study. The statistics in connection with the examination of students in evening schools, too, the report points out, reflect both the improvement in the provision of more advanced classes and the increased regularity of the attendance of the students.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 7. 1907.—"The Electrical Discharge in Monatomic Gases." By F. **Soddy** and T. D. **Mackenzie**. Communicated by Prof. J. Larmor, Sec.R.S.

Helium and argon purified by volatilising calcium (Soddy, Proc. Roy. Soc., 1907, lxxviii., A, 429) from traces of common gases show a disinclination to conduct the discharge, and the question arises whether the monatomic gases in a perfectly pure state will conduct at all. The well-known phenomenon of "running out" or exhaustion of spectrum tubes filled with these gases with prolonged use might be due to absorption of the impurities only by the electrodes leaving the pure monatomic gases in a non-conducting state. This question has been exhaustively investigated, and the conclusion is drawn that the monatomic gases conduct in the same manner as common gases, but are relatively electrically, as well as chemically, inert. That is to say, the various stages of the discharge from the X-ray vacuum to the ribbon discharge when considerable quantities of gas are present are produced in the case of helium, for example, at pressures from five to ten times the pressure required to produce the same stage of the discharge in a gas like hydrogen or nitrogen.

The "running out" of spectrum tubes filled with monatomic gases under the discharge is due to absorption of the monatomic gas principally in the film of aluminium volatilised from the electrodes. In one series of experiments six tubes were filled with helium purified by calcium at the initial pressures 1·1 mm., 2·3 mm., 4·9 mm., 8·6 mm., 16·8 mm., and 31·2 mm. The first three became non-conducting—the discharge passing an alternative spark gap of an inch of air, and the tube fluorescing strongly—with less than an hour's running, and the fourth after sixty hours, the residual pressure of pure helium in each case being about 0·7 mm. This was determined by breaking the tube under mercury, and confirmed by the use of a specially designed form of McLeod gauge. In the first case the mercury rapidly liberated the greater part of the occluded gas by dissolving the film of volatilised aluminium. The occluded gases are also slowly evolved spontaneously in the cold, and practically completely when the tube is heated to its softening point for some time.

X-rays are given out in pure helium at pressures below 0·2 mm. in an X-ray tube 8 cm. diameter, while in hydrogen X-rays are not given out until the pressure is reduced below 0·1 mm. It is probable that the real pressure in an X-ray tube is in no case below 0·01 mm., and the general impression that the pressure is of the order of 0·001 mm. is due to a variety of misapprehensions regarding high vacua. The behaviour of argon, neon, mercury vapour, nitrogen, and carbon dioxide has also been investigated.

The behaviour of helium at low pressures, at which it conducts the discharge with abnormal difficulty, is strictly analogous to its behaviour at high pressures, when it conducts with abnormal facility (Ramsay and Collie, Proc. Roy. Soc., 1896, lix., p. 257). The curves connecting discharge potential and pressure were taken in the same tube for helium and hydrogen. Helium at 60 mm. showed the same discharge potential (7750 volts) as hydrogen at 12 mm. At a pressure of 30 mm. the potential in helium was 3400 volts, and in hydrogen 16,000 volts. Throughout the whole region, both of high and low pressure, one hydrogen molecule is electrically equivalent, so far as its effect on the character of the discharge is concerned, to several helium molecules.

The remarkable observation was made that some new spectrum tubes, as obtained from the maker, generated helium during preparation and the removal of the occluded gases. The only escape from the conclusion that helium was formed under the special conditions to which the tubes had been subjected was that the helium was derived from the aluminium electrodes. Experiments were made with old aluminium electrodes which had been exposed for months to the air after removal from old spectrum tubes in which they had been used with the rare gases. By the help of the calcium method it was proved that helium, neon, and argon can be obtained in this way in quantities sufficient to give a clear spectrum from old aluminium electrodes which have been used with these gases.

All the spectrum tubes used showed strongly Campbell Swinton's effect (Proc. Roy. Soc., 1907, A, vol. lxxix., p. 134) of developing minute bubbles when fused, usually in the areas exposed to the bombardment of particles travelling normally from the surface of the electrodes; but the argon tubes showed the effect to an extraordinary extent, the glass appearing to boil when fused. Experiments are described in which these glasses have been subjected to a temperature of 1300° C. in a vacuum furnace, and all but the inert gases absorbed by calcium. Only the minutest trace of rare gas is ever obtained in this way, and this is quite insufficient to produce the effect. In the case of the glass of a helium tube which showed Campbell Swinton's effect strongly, it was proved that after a preliminary heating in a vacuum, at a temperature below that necessary to produce bubbles, to drive off surface