statement of the statutes and regulations under which the college is now governed in its new position as an integral portion of the University of London. It also contains a set of plans that show the uses to which the extension of buildings is being put. It appears that the space now available for university purposes is greater by one-third than it was last session. Among the most striking features of the new developments are the following:—the institution of a new department of geology with geological museum, rock museum, and research room; the enlargement of each of the engineering departments and of the drawing office; the enlargement of the department of applied mathematics, and the provision of special rooms to be known as the Galton research laboratories in connection with the Eugenics Institute founded by Mr. Francis Galton. The calendar also contains a section setting forth in full the arrangements for post-graduate courses of lectures and arrangements for research work. The opportunities for research work are full and ample, and the regulation with regard to admission is such that no one qualified to undertake research work ought to be debarred therefrom. It appears from the summary of students that there were no fewer than 171 post-graduate and research students in the college last session, consisting of 140 men and thirty-one women.

AT the annual meeting of the governors of the Glasgow and West of Scotland Technical College on September 24 Mr. G. T. Beilby, F.R.S., was unanimously elected chairman of the governors in succession to the late Sir William Robertson Copland. As a chemical technologist, Mr. Beilby enjoys a world-wide reputation. In industrial circles his name is more particularly associated with the Young and Beilby retort, and with a process for the manufacture of potassium cyanide. The introduction of the former revolutionised the process of shale distillation, and enabled the industry to emerge successfully from the struggle for existence; by means of the latter invention he has been instrumental in retaining an important industry in this country. As an investigator in the regions of pure science, Mr. Beilby has also established his reputation, his valuable researches on the surface structure of metals having attracted widespread attention. The second section of the new buildings for the college is in course of erection, and is expected to be ready for occupation in the session 1908–9; operations on the third section, which will complete the buildings as originally planned, will be undertaken immediately. The accommodation provided in the new buildings has enabled the college to extend its work in various directions. Recognition has been given to the importance, in a large engineering centre, of the study of fuels and their applications, and a very complete equipment has been provided in the department of technical chemistry for valuing fuels and illustrating the methods of controlling their use. This consists of calorimeters of all the various types for use with solid, liquid, and gaseous fuels, all the commonly used forms of pyrometer, and an experimental gas producer. Another feature of this department is the plant which has been installed for giving instruction in the methods of conducting technical experiments. The equipment includes grinding mills, filter and hydraulic presses, a hydro-extractor, a small refrigerating plant, pumps, an air liquefier, a steam-jacketed pan, and a double-effect vacuum evaporator plant. The laboratory in the department of motive-power engineering has been fully equipped, and in designing the equipment the object has been, not merely to provide for the illustration of principles set forth in the lecture course, but also to promote the industries of the district by obtaining information ahead of current practice. In addition to the ordinary steam, gas, and oil engines, there are several pieces of plant of special interest; with one of these engines experiments are being made from which it is hoped that information will be obtained to settle the much disputed points in the initial condensation *versus* valve leakage controversy. In the equipment of the other laboratories equal care has been shown, and every effort has been made to render them suitable for the needs of a great centre of industry.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society**, June 20.—"The Fluted Spectrum of Titanium Oxide." By A. **Fowler.**

The author has previously shown that nearly all the dark flutings which are characteristic of the spectra of Antarian or third-type stars correspond with flutings obtained from compounds of titanium.

The first part of the present paper gives an account of experiments which indicate that the flutings in question are produced by a compound of titanium with oxygen, and not by the vapour of the metal itself. The most conclusive evidence on this point was afforded by titanium chloride, which, in the absence of oxygen, did not show the Antarian flutings, although the occurrence of another group of flutings, attributed to the chloride itself, indicated that the conditions were not unfavourable for their production if their existence depended only upon the presence of titanium. Experiments with metallic titanium also showed that the Antarian flutings were only produced in the presence of oxygen.

The result is of some importance as indicating that the source of the fluted absorption in the Antarian stars is at a temperature low enough to permit the formation of a chemical compound, and also as demonstrating the presence of oxygen, of the existence of which in these stars there is otherwise no direct evidence. The investigation has lately gained additional interest in consequence of Prof. Hale's discovery of some of the less refrangible flutings in the spectra of sun-spots.

The second part of the paper contains a revised and extended table of wave-lengths, based upon photographs taken with much greater dispersion than that previously employed. For the first heads of the more prominent groups of flutings the wave-lengths tabulated are 4584·62, 4761·08, 4954·78, 5167·00, 5448·48, 5597·92, 6158·86, and 7054·5. All of these are strongly marked in the stellar spectra, that in the extreme red having lately been photographed by Slipher and Newall. Two of the stellar bands, however, about wave-lengths 5862 and 6493, do not appear to be sufficiently accounted for by titanium oxide. Photographs of the spectrum are reproduced in the paper.

Received July 4.—"The Effect of Pressure upon Arc Spectra. No. 1. Iron." By W. Geoffrey **Duffield.**

The first part of the paper contains a description of the mounting and adjustment of the large Rowland concave grating in the physical laboratory of the Manchester University. The feature of this is the stability of the carriages carrying the grating and camera, and the novel construction and attachment of the cross-beam, which secure the absence of any disturbance which might be caused by bending or sagging.

The second part describes experiments made with a pressure cylinder designed by Mr. J. E. Petavel, F.R.S., in which an arc is formed between metal poles opposite a glass window, through which the light is examined by means of the grating spectroscope. A system of mirrors allows the image of the arc, however unsteady it may be, to be kept almost continuously in focus upon the slit.

Two sets of photographs of the iron arc in air have been taken for pressures ranging from 1 to 101 atmospheres (absolute), and the results are given below for wave-lengths $\lambda=4000$ Å.U. to $\lambda=4500$ Å.U.

I. *Broadening.*

(1) With increase of pressure all lines become broader.

(2) The amount of broadening is different for different lines, some almost becoming bands at high pressures, and others remaining comparatively sharp.

(3) The broadening may be symmetrical or unsymmetrical; in the latter case the broadening is greater on the red side.

II. *Displacement.*

(1) Under pressure the most intense portion of every line is displaced from the position it occupies at a pressure of 1 atmosphere.

(2) Reversed as well as bright lines are displaced.

(3) With increase of pressure the displacement is towards the red side of the spectrum.

(4) The displacement is real, and is not due to unsymmetrical broadening.

(5) The displacements are different for different lines.

(6) The lines of the iron arc can be grouped into series according to the amounts of their displacements.

(7) Three groups can in this way be distinguished from one another; the displacements of Groups I., II., III. bear to one another the approximate ratio 1 : 2 : 4. (The existence of a fourth group is suggested by the behaviour of two lines, but further evidence is needed upon this point; 1 : 2 : 4 : 8 would be the approximate relations existing between the four groups.)

(8) Though all the lines examined, with two possible exceptions, fall into one or other of these groups, the lines belonging to any one group differ to an appreciable extent among themselves in the amounts of their displacements.

(9) The relation between the pressure and the displacement is in general a linear one, but some photographs taken at 15, 20, and 25 atmospheres pressure give readings incompatible with this relation. Other photographs at 15 and 25 atmospheres present values which are compatible with it.

(10) The abnormal readings are approximately twice those required by the displacements at other pressures, if the displacement is to be a continuous and linear function of the pressure throughout.

(11) On the photographs showing abnormal displacements the reversals are more numerous and broader than they are on plates giving normal values, and there is some evidence in favour of a connection between the occurrence of abnormal displacements and the tendency of the lines to reverse.

III. *Reversal.*

(1) As the pressure is increased, reversals at first become more numerous and broader.

(2) The tendency of the lines to reverse reaches a maximum in the neighbourhood of 20 to 25 atmospheres, and a further increase in pressure reduces their number and width.

(3) Two types of reversal appear on the photographs, symmetrical and unsymmetrical.

(4) Within the range of pressure investigated, the reversals show no tendency to change their type.

(5) In the case of unsymmetrically reversed lines in the electric arc, the reversed portion does not in general correspond to the most intense part of the emission line, being usually on its more refrangible side.

(6) The displacements of the reversed parts of the unsymmetrically reversed lines of Group III. are about one-half the displacements of the corresponding emission lines. Indeed, the reversed parts of the lines of Group III. fall approximately in Group II.

(7) No relation between the order of reversal and the frequency of vibration, such as exists in the spark, has been observed in the iron arc for the ranges of wavelength and pressure examined.

IV. *Intensity.*

(1) The intensity of the light emitted by the iron arc is, under high pressure, much greater than at normal atmospheric pressure.

(2) Changes in relative intensity of the lines are produced by pressure. Lists of enhanced and weakened lines are given.

PARIS.

**Academy of Sciences**, September 23.—M. Henri Becquerel in the chair.—The red disease of the pines in the Upper Jura: E. L. **Bouvier.** This disease attacks *Abies pectinata* and leaves Picea untouched, and during the last year has assumed alarming proportions in the Jura. A fungus would appear to be the cause of the disease, and as this attacks firs only, it is proposed as a remedial measure to plant no more pines, but to replace them with Picea. Trees that are attacked should be cut down, since their vitality is already destroyed.—Parthenogenesis without oxygen. The elevation of the parthenogenetic larvæ of Asteria up to the perfect form: Yves **Delage.** The author has repeated the experiments of Loeb on the influence of the absence of oxygen, but cannot confirm them; oxygen does not appear to have the influence accorded to it by Loeb. The preparation of the solution for the development experiments has been simplified, and now consists of 300 c.c. of sea water, 700 c.c. of a solution containing 388 grams of saccharose per litre, 0·15 gram of tannin dissolved in a little water, and 3 c.c. of a normal solution of ammonia. The eggs, extracted from the ovary, are placed for one hour in 50 c.c. of this solution, then placed in sea water, two or three times renewed by decantation in order to remove all traces of the reagent. After eighteen hours the vessel swarms with living larvæ. Details are given of all the sea-urchins which have reached the fully developed stage, including one abnormal specimen possessing hexameral symmetry.—The series of methylation of ethyl alcohol from the point of view of the aptitude of isomerisation of the haloid esters: Louis **Henry.** The change of an alkyl halide into an isomer usually means the transference of the halogen atom to a carbon atom combined with a smaller number of hydrogen atoms than the original carbon atom.—The Daniel (1907) comet and its spectrum: Henri **Chrétien.**—Special iron castings, and more especially castings containing nickel: Léon **Guillet.** The net result of this, together with the previous work on the same subject, is that elements such as nickel, aluminium, and silicon, which dissolve in the iron, favour the formation of graphite. Elements which form a double carbide with cementite oppose the formation of graphite (manganese, chromium).—Experimental researches on the lesions following compression and crushing of the sensitive ganglia: G. **Marinesco** and J. **Minea.**—Memory in *Convoluta roscoffensis*: Louis **Martin.** Specimens of Convoluta removed from the seashore and placed in a jar in the laboratory oscillate for a certain time in synchronism with the time of the tides. Under certain conditions, which are described in detail, this memory disappears.—Contribution to the study of the lower valley of the river Ain: J. B. **Martin.**

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