I.H.P. was 5·10, the gas per I.H.P. per hour 20·35 cubic feet, the heat expended per I.H.P. per hour was 12,186 thermal units, or 10·95 thermal units per explosion. The thermal efficiency was 21 per cent. Taking one of the low-speed experiments, with the ratio of air to gas of 10·4, the compression per square inch absolute was 86 lbs., the ratio of clearance to cylinder volume was 0·37, the revolutions per minute were 117·6, and the ratio of actual explosions to the maximum possible was 75 per cent. With these conditions the I H.P. was 1·84, the gas used per I.H.P. per hour 28·2 cubic feet, the heat expended was 17,041 thermal units per I.H.P. per hour; that gave a thermal efficiency of 15 per cent., a result which, as the author remarks, was distinctly uneconomical. In the following test the compression was 102 lbs. absolute, the ratio of clearance to cylinder volume being 0·25, the revolutions and the I.H.P. were practically the same, but 31 cubic feet of gas were used per I.H.P. per hour; the thermal efficiency, therefore, being 13·6 per cent, although the compression was so much higher than in the previous test mentioned, almost approaching that of the full-speed test first referred to.

In connection with this matter, the fact commented upon during the discussion may be referred to. The older gas engines were designed for lower pressures; and it is found with them that increasing the compression does not add to economy. The ratio of clearance has an important bearing on the case, the port surface acting as a condenser, and an increase in the compression induces a degree of cooling which is not economical. There is also the loss by leakage through the indicator, the proportion of which will be considerable in the case of a small engine. The Wayne indicator used during the experiments has a rotating piston not touching the sides of the cylinder, and therefore admitting of constant leakage. In the steam engine the loss from leakage through the indicator is comparatively unimportant, being governed by the pressure present in the cylinder at any given time. With the gas engine, however, this is different, as the working mixture escapes through the cylinder before ignition. One of the speakers humorously likened the effect of an indicator on a small gas engine to a big whistle on a steam launch boiler. He said that in the early days of steam launches a friend of his had a small paddle yacht with a very big whistle, which was fitted in order that he might let his friends know when he was coming. He found, however, that when he paddled he could not whistle, and when he whistled he could not paddle.

A brake was used in the experiments, and perhaps it would have been better if Brake H.P. had been given in the tables. It was found that the measurement of gas by means of an ordinary meter, although giving a correct aggregate result, possessed the disadvantage of not controlling the fluctuations of pressure in the mains; a calibrated gas-holder was therefore used. The amount of air used per stroke was measured by a meter into which air was forced by a Sturtevant blower, the pressure being kept constant by means of a gas governor; precautions were taken to prevent back ignition; a rubber gas bag was used to obviate the fluctuation in pressure in the meter during the suction stroke. No difficulty was found in working this apparatus. Records were taken of pressure and temperature of the air; measurement of the heat rejected was effected by running the cooling water from the calibrated tank through the water jacket and thence to the discharge, the capacity of the tank being sufficient to hold water for a single test. The temperatures of the inlet and outlet water were taken. The glass stems of the thermometers were attached to brass plugs by means of soldering with Thomas's fusible metal, which enables glass and brass to be fixed together with a pressure-tight joint. To obtain samples of the exhaust gases, a single bubble of gas was taken from just below the exhaust-valve after each explosion stroke by means of suitable apparatus, which was illustrated by a wall diagram shown during the reading of the paper. The Wayne indicator used to find the I.H.P. was considered superior to the Richards, Crosby, Darke or Tabor indicators. It was made by Messrs. Elliot Brothers. This indicator appears to be similar in principle to one introduced by Mr. Michael Longridge some years ago. For reducing pencil friction to a minimum, cards of smoked mica were introduced in place of the usual paper. An iron tube was used for ignition, electrical methods having been tried, but were not found satisfactory.

The author, in giving a summary of the experiments, concluded that it was probable that the influence of increased compression on economy was due to the fact that weaker charges can be burnt completely during the stroke when the compression is high. It should be stated that in the test of which we have given particulars, in which the thermal efficiency was 21 per cent., the author considered that more economical results than this could be obtained, as the ratio of air to gas was 8·6, which was certainly higher than necessary. It may be added that the best mixture for a modern gas engine is considered to be one of gas to ten of air by volume. The report continued that the test seemed to indicate that economy depends on the choice of the correct ratio of air to gas, and that this ratio increases with compression. The number of experiments was not yet sufficient to determine what any ratio was for any given compression, but it is stated that further tests are to be made for arriving at this important point.

The summer meeting of the Institution will be held this year in Derby.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. Charles Godfrey, of Trinity College, has been elected to the Isaac Newton Studentship in Physical Astronomy.

The General Board of Studies propose that the Professorship of Surgery, held by the late Sir George Humphry, be suspended until the Senate shall otherwise determine. Meanwhile the duties of the office are to be discharged by a Reader in Surgery, at a stipend of 240*l.* a year.

The General Board also propose to recognise the continued liberality of the Royal Geographical Society in providing for the endowment of geographical teaching, and the importance of encouraging the study of the subject in the University by raising the present Lectureship, held by Mr. Yule Oldham, to a Readership in Geography, with a total stipend of 200*l.* a year.

DR. KARL HÜRTHLE, assistant professor of physiology at Breslau, has been appointed professor of physiology and director of the Physiological Institute, in succession to the late Prof. Heidenhain.

THE Council of King's College, London, have received from the Trustees of the British Museum a valuable series of fossils, in aid of the teaching collection for the Geological Laboratory in the Science and Engineering Faculty.

AN anonymous donor has offered 10,000*l.* for the completion of the extension scheme of Aberdeen University, on the condition that 20,000*l.* is obtained from the Government for the same object. The Chancellor of the Exchequer has agreed to receive a deputation on behalf of the movement for the extension of the University.

Science states that at the semi-annual meeting of the Board of Trustees of Beloit College it was announced that the College had received a gift of 25,000 dollars for the endowment of the chair of Chemistry, now occupied by Prof. E. G. Smith. The donor wishes to remain anonymous. It was also reported that the sum of 70,000 dollars had been raised towards the 100,000 dollars necessary to secure Dr. Pearson's gift of 50,000 dollars.

THE rapid progress of medical education and the enlargement of the requirements of the Examining Boards have rendered it imperative to provide more space for the teaching of several important subjects in the London Hospital Medical College. Consequently a large portion of the College is about to be rebuilt and enlarged, and all the necessary class-rooms and laboratories provided. It is intended that the work will be completed by the commencement of next winter session.

THE magnitude of the operations of the Department of Science and Art may be judged from the figures given in the Calendar of the Department for 1898. The total number of individual students in science classes held under the auspices of the Department was 157,984. The subjects which attracted more than ten thousand students in the year covered by the Calendar are: Mathematics (Stages 1, 2, 3), 40,244; Inorganic Chemistry (Theoretical), 26,433; Practical Plane and Solid Geometry, 24,069; Physiography, 22,409; Machine Construction and Drawing, 19,952; Building Construction, 15,195; Magnetism and Electricity, 12,591; Hygiene, 10,143. At the other end of the scale we find that mineralogy only attracted 152 students, and zoology 189. Nine of the depart-

mental subjects are practical; and the number of students who took practical work is as follows: Inorganic Chemistry, 15,169; Magnetism and Electricity, 2694; Sound, Light, and Heat, 1793; Organic Chemistry, 1538. The remaining practical subjects—human physiology, general biology, zoology, botany, and metallurgy—divided 1852 students between them. There are now 169 Schools of Science in which organised courses of study are taken in connection with the Department, and the number of students attending them is 20,879.

SCIENTIFIC SERIALS.

THE most important contribution to *Himmel und Erde* for this month is a long paper on the terminal moraines of North Germany. The other papers comprise one in which is given the conclusion of a lecture by Dr. Drygalski on Greenland, dealing mainly, in this part, with the habits and customs of the Esquimaux; and another by Herr G. von Gleicke treating of the existence of an intra-mercurial planet or planets, generally surveying the various theories that have been put forward to explain the motion of the perihelion of Mercury. The only result that appears certain in the paper is the practical confirmation of the reality of the motion, originally determined by Le Verrier. The presence of a single planet or of a ring of meteoric matter; the existence of an unknown satellite of the planet itself, or an ellipticity in the figure of the sun; an alteration in the expression of the law of gravitation or the introduction of terms suggested by electrodynamic considerations; all seem to offer insuperable objections, or to be based on pure empiricism. The enigma is not solved yet. The subjects to which the shorter notes refer have generally been mentioned in these columns. They include some account of the Greenland Meteor; the sinking of the surface of the earth in the neighbourhood of the Canadian lakes, and its effect on the Niagara Falls; the depth of the sea and the determination of ocean currents around Australia derived from floating bottles. A short notice is also added of a proposed attempt on the part of MM. Godard and Surcouf to reach the North Pole by means of ballooning. The expedition would start in the summer of 1898, selecting Spitsbergen as a base of operations. The peculiar feature of the attempt seems to consist in carrying twelve small balloons, filled with hydrogen to serve as a gasometer to supply the main balloon, which is of gigantic dimensions, with the gas which may leak or waste. M. Godard counts on spending sixty days aloft, and to carry with him the means of support of no less than seven people, among whom will be found a chemist, a meteorologist, and a physician.

Memoirs of the Caucasian Branch of the Russian Geographical Society, vol. xviii.—On the distribution of precipitation in Caucasia during the spring and summer of 1894, by A. Woznesensky, with four maps.—Journey in the Chernomorsk district, in 1894, by N. Alboff; with a map (on the scale of seven miles to an inch) of the Chernomorsk district and the western part of the district of Sukhum; and botanico-geographical researches in Western Transcaucasia, by the same author, being a continuation of his paper inserted in a preceding volume of his *Memoirs*. In this paper two important excursions across the main ridge of Abhasia are described. The flora of the limestone-mountains having been the special subject of studies, it is dealt with in detail. The rare new species *Amphoricarpus elegans*, which was formerly found at two places only of Abhasia and Mingrelia, was met with in thousands. A bush-like *Campanula*, which M. Alboff considers as a new species, was found and was named *C. regina* for its rare beauty. Numbers of other rare species were found. Detailed lists of the limestones' fauna in Abhasia and Mingrelia are given. In addition to the glaciers previously discovered on the northern slope, a hanging glacier was found on the southern slope. Very interesting remains of the ancient population of the region are mentioned.—On the Kumyks, anthropological sketch by J. Pantukhoff. The paper contains a sketch dealing with the possible origin of this Tartar stem, anthropological measurements made by the author, and a comparison of the same with measurements on other Caucasian stems.—The Pshaves and their land, by D. Khizanachwili.—A journey in the central portion of the Mountain-Chechnya, by Madame A. Rossikoff, with a map three and a half miles to the inch. Detailed and lively account of a journey in that imperfectly known part of Daghestan, the seat of Shamil's wars.—Statistical description of, and statistical data relative to, the provinces of Baku, Kars, Erivan, Daghestan, and Elisabethpol.—On the condition of glaciers and of the lakes on the northern slope of Central Caucasus, by K. Rossikoff.—In a very interesting appendix we find (1) a beautiful atlas of eight ethnographical maps of Transcaucasia, one for each separate province, on the scale of thirteen miles to an inch (it is the work of E. Kondratenko); (2) a map of the distribution of the Armenian population in Asia Minor, on the basis of V. Cuinet's data, 1890-94, accompanied by a paper by General Zelenyi and Colonel Sysoeff; and (3) the distribution of Armenian populations in Transcaucasia.

WE have received the number of the *Irish Naturalist* for February, and are always glad to say a word on behalf of these local natural history journals, which have done so much to encourage the early enthusiasm of many who have afterwards become eminent naturalists. In the present number Mr. Allan P. Swan describes and figures a new species of *Leptolegnia*, *L. bandoniensis*, belonging to the *Saprolegniaceæ*.

THE *Journal of Botany*, in its numbers for January and February, still continues to cater chiefly for descriptive and "critical" botanists. Mr. F. Townsend describes and figures a new species of *Euphrasia*, *E. canadensis*, from the neighbourhood of Quebec; and Miss Ella M. Tindall enriches British Hepaticæ with a species new to science, *Fossombronia Mittenii*, from North Devon, which is also figured

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, January 20.—"Fergusonite, an Endothermic Mineral." By William Ramsay, Ph.D., LL.D., Sc.D., F.R.S., and Morris W. Travers, B.Sc.

The mineral fergusonite, discovered by Hartwall, occurs in felspar and mica deposits, in the same manner as most of the rare Norwegian minerals, such as euxenite, orthite, samarskite, &c. The position in which such minerals are found, embedded in masses of felspar, or encrusted with mica, leaves the question of their origin an open one. Whether they are deposited in the felspar by water, or whether they are contemporaneous with the felspar, is a matter of speculation. Fergusonite is a black lustrous mineral, not unlike obsidian in outward appearance, but of considerably higher density. Seen under the microscope, even with the highest power, there is absolutely no sign of crystalline structure, though in thin slices the substance is translucent, and transmits yellow-brown light. It is, however, macrocrystalline, occurring in quadratic sphenoids. It is quite homogeneous, and displays no sign of cavities. Like similar minerals, it contains helium, which is expelled on the application of heat.

But this mineral presents a peculiarity, which has led us to publish this note. When heated to a temperature not exceeding 500° or 600°, it suddenly becomes incandescent, and evolves much of its helium; while its density decreases.

The analysis of the mineral was kindly undertaken by Miss Emily Aston, to whom we desire to express our indebtedness.

It showed that fergusonite is mainly a niobate of yttrium, containing oxides of uranium, but in no great quantity.

The gases evolved by the incandescence of nearly 5 grams (4·852) of the mineral, heated in a vacuous tube, were analysed and found to consist of helium, hydrogen, carbon dioxide, and nitrogen.

The density was determined before and after heating. Great care was taken to make sure of the absence of air-bells, by warming the powdered mineral under water in a vacuum, before weighing it.

Density before heating	5·619
,, after ,, ...	5·375

It is thus seen that the mineral loses density on incandescence.

The amount of heat lost by this curious mineral in parting with its helium was determined. The plan of operation was to burn in oxygen a known weight of hydrogen, ascertained by measuring it, under a small platinum crucible, in a calorimeter. The rise of temperature was noted. This operation was repeated several times, so as to standardise the calorimeter. Some grams of mineral were then placed in the crucible, and the operation was repeated; the heat evolved by the incandescing mineral added itself to that from the burning hydrogen, and the