

measurement of temperature up to 1750° C. were presented by Dr. A. L. Day, director of the Geophysical Laboratory of the Carnegie Institution. The range through which temperatures can now be determined in terms of the fundamental definition (the expansion of gas under constant volume or pressure) has now reached nearly to the absolute zero downward, and to 1550° C. upward. The present investigation is concerned with the higher temperatures lying between 300° and 1550° . The accuracy attained in the present investigation within this region is about 0.2° in the vicinity of 300° and 2° at 1550° . For the purpose of establishing temperatures of reference in this region for general use, the following constants have been determined:—

Cadmium (melting point)	$320.8^{\circ} \pm 0.1^{\circ}$
Zinc (melting point)	$419.3^{\circ} \pm 0.1^{\circ}$
Sulphur (boiling point)	$444.5^{\circ} \pm 0.1^{\circ}$
Antimony (melting point)	$629.8^{\circ} \pm 0.2^{\circ}$
Silver " "	$960.0^{\circ} \pm 0.7^{\circ}$
Gold " "	$1062.4^{\circ} \pm 0.8^{\circ}$
Copper " "	$1082.6^{\circ} \pm 0.8^{\circ}$
Li_2SiO_3 " "	$1201.0^{\circ} \pm 1.0^{\circ}$
Nickel " "	$1452.3^{\circ} \pm 2.0^{\circ}$
Palladium " "	$1549.2^{\circ} \pm 2.0^{\circ}$
Platinum " "	$1752.0^{\circ} \pm 5.0^{\circ}$

New magnetic charts of the Indian Ocean (illustrated) were described by Dr. L. A. Bauer. The charts embody the results of magnetic observations made during the summer and fall of 1911 on board the non-magnetic yacht *Carnegie*. The necessity of the new charts arose from the exceptionally large errors found in the magnetic charts at present in use by mariners. Thus, for example, the errors in the charted compass directions for two of the most recent charts approximate respectively 4° and 6° , though one of the charts was issued as recently as 1910. With the exception of a few values found by the vessel used in the Pacific Ocean work, namely, the *Galilee*, these are the largest errors thus far revealed. In the portions of the Atlantic Ocean covered by the *Carnegie*, the compass chart errors have generally been below 2° , though running at times up to $2\frac{1}{2}^{\circ}$. The chart errors in the compass directions are usually found to be systematic, that is, in the same direction for large stretches, and are to be ascribed largely to erroneous secular changes allowed for in attempting to bring previously observed values up to date. The errors in the other magnetic elements, while of less importance to the mariner, are of consequence to theoretical investigations regarding the earth's magnetism. In the magnetic dip the errors on the present cruise have amounted at times to 4° , and in the horizontal intensity to about one-twentieth part.

During the afternoon of April 20 Prof. W. W. Campbell, of Lick Observatory, University of California, contributed a paper on radial velocity to a symposium on stellar spectroscopy. All observed stellar motions, he said, contain components due to the motions of the observer. The first step in studies of stellar motions is to determine the elements of the solar motion and to eliminate its effects from the observed motions of the stars, thus leaving the motions with reference to the stellar system. The direction of the solar motion has long been fairly well known: the solar system is approaching a point 10° or 15° south-west of Vega. The speed determined from 1200 radial velocities is $19\frac{1}{2}$ kilometres (12 miles) per second. The velocities of the stars are functions of their spectral classes, *i.e.* of their effective ages. The young stars are travelling slowly—12 kilometres per second on the average; the middle-aged stars more rapidly— $28 \pm$ km. per second; and the old stars the most rapidly— $34 \pm$ km. per second. Our sun, as a middle-aged star, is travelling with a speed

of $19\frac{1}{2}$ km. per second—far below the average of its class. We do not know why stars increase their speeds as they grow older. Among the brighter and nearer stars, those resembling our sun in effective age predominate, and they partake somewhat of the solar motion. Neglecting these brighter middle-aged stars, the remaining stars form a fairly homogeneous mixture of stars of all ages. Radial velocity data increase our estimate of the scale of the universe about 50 per cent. above proper motion estimates. There is the utmost need for cooperation amongst astronomers in observing the radial velocities of stars between the fifth and seventh magnitudes.

The relations between the spectra and other characteristics of the stars formed the subject of a paper by Prof. H. N. Russell. Among the stars the distances of which can be measured with some approach to accuracy, and the real brightness of which can thus be determined, there exists, with few exceptions, a very marked relation between the actual brightness and the class of spectrum. Stars resembling Sirius in their spectra are, on the average, about fifty times as bright as the sun, those like Procyon about five times as bright as the sun, those with spectra like the sun's are nearly equal to the sun in brightness; while the orange stars average only one-sixth as bright, and red stars are usually less than one-fiftieth, as bright as the sun. There exist, however, many stars of great brightness, of all spectral types, which are almost so remote that their distances cannot be accurately measured. From the best available data, these stars appear to be, on the average, from 100 to 250 times as bright as the sun, without much difference between the different spectral types. Among the stars redder than the sun, these two groups, of different brightness, are widely separated; but among the whiter stars they run together, and become identical for the whitest stars, which average more than 250 times as bright as the sun. From a study of double stars, it is found that the stars of the brighter class do not greatly exceed those of the fainter class in mass, and hence that they are either much less dense or much brighter per unit of surface, or both. An arrangement of all these groups of stars in order of increasing density would begin with the bright red stars of the type of Antares, run up the series of stars of great brightness to those of spectrum B, and then down the series of fainter stars, past those like the sun, to the faintest and reddest stars. It seems probable that this arrangement represents the evolutionary history of a star, which at first becomes heated more and more by its own contraction, and, finally, as it becomes too dense to admit of further shrinkage, cools off like a solid body.

An important feature of the annual dinner in connection with the meeting was the presentation to Mr. C. H. Burr, of Philadelphia, of the Henry M. Phillips prize of 400l. to the author of the essay on "The Treaty-making Power of the United States and the Methods of its Enforcement as affecting the Police Powers of the States."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—In commemoration of the opening of the new buildings in 1909 by his late Majesty King Edward VII., the pro-vice-chancellor (Alderman F. C. Clayton) has presented to the University a statue of that monarch. The statue, which is the work of Mr. Alfred Drury, stands in the entrance hall of the main block. It is of white marble, and represents his Majesty in Garter dress, holding the sceptre in his

right hand and the orb in his left. The attitude is one of remarkable dignity, and the general effect is a happy one. On the base of the statue is the following inscription:—"His Majesty King Edward VII., accompanied by Queen Alexandra, opened these buildings on July 7th, 1909, and concluded his address thus: "To you, the students, I say that the honour and dignity of this University are largely in your hands, and I look to you to initiate and hand down worthy traditions to your successors." It is understood that the unveiling ceremony is to be performed on June 27 by Mrs. Joseph Chamberlain, wife of the Chancellor of the University.

CAMBRIDGE.—The Research Hospital, which was opened on Friday last, May 24, stands about a mile south of the railway bridge at Cambridge on a site one acre in area. The object of the hospital is an intensive study of one disease at a time. In an ordinary hospital a patient comes in, undergoes certain treatment, gets better or is found incapable of improvement, and is sent out to make room for a further specimen of our suffering humanity. This will not be the case at the Cambridge Research Hospital. The study there is not so much the alleviation of one specific case of disease as the attempt to discover the causation of certain obscure diseases, and to experiment not only on their cure, but on their prevention. It may be put shortly by saying that, instead of one physician attending a large number of hospital cases of varying nature, at the Cambridge Research Hospital the best medical talent available from every side will be concentrated on three or four patients all suffering from one definite disease. At present the disease under investigation is rheumatoid arthritis, and experiments as to the cause of this terrible malady have been for some years carried on at Cambridge, at first in lodgings, and then in a small villa rented for the purpose. Owing to the energy of Mr. T. S. P. Strangeways, Huddersfield lecturer in special pathology in the University, and to the support he has received from Mr. R. C. Brown, of Preston, these patients are now transferred into a fine and commodious hospital.

The Public Orator spoke as follows in presenting Mr. R. C. Brown for the degree of Master of Arts *honoris causa* on May 23:—"Medicum modestum, medicum munificum, qui tot alios tam diu salvare iussit, ipsum hodie iubemus salvare. Lancastrensius in comitatu medio, in oppido suo natali, Salutis templo amplificando, et in melius mutando, quantum temporis, quantum pecuniae dedicavit! Ibi pauperum tabernis quantam lucem, quantam salubritatem, quot vitae melioris commoda intulit! Arti musicae deditus, convalescentibus ars illa quantum prosit, quam sollerter indicavit; quod nemini vestrum mirum sit, novimus enim ipsum Apollinem non modo Aesculapii patrem, sed etiam Musarum omnium, atque adeo artis musicae, fuisse patronum. Idem eos, qui inter nosmet ipsos in certos quosdam morbos curiosius inquirunt, liberalitate maxima adiuvit; instrumentis subtilissimis ornavit; militiae denique huius tironibus stipendia quotannis distribuenda curavit. Vir igitur in artem medicam tam munificus, artium magister hodie honoris causa merito nominatur. Idem domicilium novum his studiis benefactorum complurium liberalitate dedicatum die crastino auspiciis optimis inaugurabit. Duco ad vos medicum insignem, virum et medicinae in studium et in Academiam nostram munificum, Robertum Carolum Brown."

The Extension of the School of Agriculture Syndicate reports that the Lords Commissioners of the Treasury have approved of a grant not exceeding 14,500*l.* from the Development Fund for the building and equipment of an extension of the School of Agri-

culture, chiefly for the accommodation of research institutes in plant breeding and animal nutrition. Of this sum it is proposed to expend about 3000*l.* on fittings and equipment, and about 11,500*l.* on the actual building.

The Board of Agricultural Studies, in consultation with the president of the Royal Agricultural Society, has appointed Mr. C. R. Fay to be the Gilbey lecturer on the history and economics of agriculture.

DUBLIN.—The Chancellor of the University of Dublin (the Rt. Hon. Viscount Iveagh), having learned that the Department of Geology and Mineralogy was in need of endowment for the prosecution of research and for equipment, has presented the authorities of Trinity College with the sum of 10,000*l.*, to be invested, and the proceeds to be applied in part to the payment of a research assistant and in part to the purchase of apparatus, &c., required for the school and for investigation. It will be remembered that in response to the appeal of a science schools committee and of the former chancellor, the late Earl of Rosse, Lord Iveagh has already given nearly 25,000*l.* for the construction of laboratories for experimental physics and for botanical science, the fund required for the upkeep of these departments being contributed by graduates and friends of the University. The movement of reform initiated by the Science Schools Committee was for various reasons arrested shortly after the claims of the School of Geology and Mineralogy were put forward by the committee. This department, therefore, failed to derive any appreciable benefit from the movement, a result which was particularly unfortunate, as it was specially active in carrying out and promoting research. The serious financial restrictions which hampered its work have now been removed by the generous gift of Viscount Iveagh.

MR. M. POWER, lecturer in mathematics in University College, Dublin, has been appointed professor of mathematics in University College, Galway.

PROF. D'ARCY W. THOMPSON, C.B., professor of natural history in the University College, Dundee, has been appointed Herbert Spencer lecturer at the University of Oxford for 1912.

THE Vice-Chancellor of the University of London (Sir William Collins) will present the prizes to the students of the London (Royal Free Hospital) School of Medicine for Women on Friday, June 7, at 4 p.m. Mrs. Garrett Anderson, president of the school, will be in the chair.

PROF. F. G. DONNAN, Muspratt professor of physical chemistry in the University of Liverpool, has decided to decline the chair of chemistry at University College, London, in succession to Sir William Ramsay, K.C.B., for which he was nominated recently, and to remain in Liverpool.

THE Board of Agriculture and Fisheries will award twelve research scholarships in agricultural science in October next if so many suitable candidates present themselves. These scholarships have been established in order to train promising students under suitable supervision, with the view of their contributing to the development of agriculture, either by carrying out independent research, or by acting in an advisory capacity to agriculturists. They will be granted only to students who show distinct promise of capacity for advanced study and research in some one of the sciences bearing on agriculture. The scholarships will be of the annual value of 150*l.*, and will be tenable for three years, provided that satisfactory reports are made at the end of each year as

to the conduct and capacity of the holder by the authority under whose supervision the scholar is placed by the Board. The scholar will be required, as a general rule, to spend some part of the three years at an approved Continental laboratory or university. An applicant for a scholarship must be (a) a graduate of a university, or (b) the holder of a diploma of a university or college of university rank. He must be nominated by a professor or lecturer of a university or college of university rank. Nominations must be received not later than June 17.

THE sixth annual report, that for 1911, of the Apprenticeship and Skilled Employment Association shows that with the advent of the juvenile advisory committees—now established under the Board of Trade in connection with every labour exchange in London—there has still been scope for the work of a voluntary society in the organised effort to improve the industrial conditions of young people. During the year a working scheme of cooperation has been devised between the association and the official juvenile advisory committees. The Board of Trade has shown its recognition of the work done by the association by nominating many of the members of its affiliated committees to serve on the local juvenile advisory committees. The functions of the association are of a twofold character: through its local committees it places children as they leave school in situations where an adequate industrial training may be secured, and the central office serves as a co-ordinating body, collecting industrial information and acting as a clearing-house in the matter of vacancies. The friendly relations that have always existed between the London County Council and the association have been maintained. As in the past two years, the central office has, at the request of the Council, continued to place laboratory monitors in work as they leave the Council's service. The finances of the association are not in the satisfactory condition the excellence of its work merits, and an appeal is made in the report for further assistance. Donations may be sent to the honorary treasurer at the office of the association, 36 Denison House, Vauxhall Bridge Road, London, S.W.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, May 10.—Prof. A. Schuster, F.R.S., president, in the chair.—Dr. J. A. Harker and Dr. G. W. C. Kaye: The generation of electricity by carbon at high temperatures. The experiments described owe their origin to some contamination phenomena which were encountered when tubes of refractory rare earths were baked in carbon-tube resistance furnaces at temperatures from 1500° C. upwards. It was found that the tubes often had their outer surfaces carbonised to an appreciable depth, while the inner surfaces, though freely exposed, were much less attacked. The blackening was presumably caused by particles shot from the carbon walls of the furnace with velocity high enough to penetrate the refractory material after crossing a few millimetres of air at atmospheric pressure. The preliminary experiments on the nature of these particles were carried out by the use of two insulated exploring electrodes of carbon inserted into an alternating-current furnace. They were connected externally to a battery of cells, and the potential-current curves were determined for the electrode gap in the furnace at a number of temperatures. No appreciable current could be detected at temperatures below about 1400° C., but as the temperature rose it was found that quite small E.M.F.'s gave rise to steady

currents of relatively enormous magnitude. For example, with 8 volts, currents up to 10 amperes have been obtained at a temperature of about 2500° C. The relation between current and temperature was found to be of an exponential character.—S. **Butterworth**: A method of measuring small inductances. The author shows how Anderson's method may be modified so that, while still retaining the usual standards of capacity, very small inductances may be measured. As in Anderson's method, balance is attained by a simple resistance adjustment. The conditions of maximum sensibility are indicated, and experimental results are quoted in which an inductance of 20 microhenries is compared with a capacity of 0.1 mfd. The method may also be employed to compare a very low capacity with the usual mica standards of capacity.—H. A. **Colwell** and Dr. S. **Russ**: The conversion of starch into dextrin by X-rays. When solutions of starch are irradiated for several hours by X-rays of moderate penetrating power, the opacity and viscosity of the solutions are markedly diminished. These physical changes are attended by chemical changes; there is a partial conversion of the starch into soluble starch and dextrin. A quantitative estimation of the amount of dextrin formed after the starch solution had been irradiated for eight and a half hours showed that it corresponded to about 5 per cent. of the amount of starch initially present. When solutions of dextrin were subjected to a similar exposure of X-rays, no conversion of this substance into glucose was obtained.

Institution of Mining and Metallurgy, May 16.—Mr. Edward Hooper, president, in the chair.—J. B. **Tyrrell**: The law of the paystreak in placer deposits. This paper embodied the results of a study of the placer deposits of the Klondike district with the view of determining the laws which govern the deposition of placers and the formation of the run of coarse gold usually found in the bottom of the larger valleys. The author believed that the laws or principles he enunciated with reference to the Klondike have a general application to the concentration of heavy metals or minerals in alluvial deposits. He then proceeded to describe the various stages of development which the existing valleys have undergone with the view of showing the probable course of events which have resulted in the present position of the "paystreak."—F. Percy **Rolle**: Illogical precision in mine reports. The author of this paper directed attention to the prevalent custom of expressing large tonnages to the extreme accuracy of a single ton, and of reporting mine assays to excessive minuteness, and he aimed at showing that such practice is inconsistent, since the same or a greater actual degree of accuracy can be attained by simpler "round figures." He gave examples in illustration of his contention to show what varying results may be obtained according to the "personal equation" of the mine engineer or assayer. For example, a reserve of ore was separately estimated by two experts, each estimate being expressed to the accuracy of one in a million, while the two varied to the extent of one in ten, the difference being considerably more than 100,000 tons. Similarly, in mine assays, values are given at times to a single penny, when assay results taken from different parts of the face show wide variations from which an average value can only with difficulty be deduced to the limits of accuracy of a shilling unit.—Leon **Perret**: Gold and platinum alluvial deposits in Russia. This was an exhaustive review of the growth and present position of gold and platinum alluvial mining in Russia, and contained a number of interesting details in relation to the special conditions necessitated by climatic and other peculiarities.