beyond all question the structural formula of camphor, that the confirmation now given of the validity of the synthesis is of considerable value and importance.

AN article on petrol-engine ratings appears in *Engineering* for February 10. It has never been altogether clear why so much ingenuity has been expended in the invention of formulæ which will give the horse-power of a petrol engine in terms of its physical dimensions, especially as most builders of such engines are quite prepared to state the actual brake-horse-power which has been given by any of their engines. In 1906 the Royal Automobile Club settled on the well-known formula $B.H.P. = 0{\cdot}4D^2N$. This formula is founded on an assumed mean effective pressure of 67·2 lb. per square inch and a piston speed of 1000 feet per minute. A report was presented at the meeting of the Incorporated Institution of Automobile Engineers on February 8, drawn up by the horse-power-formula committee. A new formula is given which avoids the objections raised to that given above, viz. the assumption of values for both the mean pressure and the piston speed, and the form being such that no correction can be applied for the increase of mean pressure which takes place with increase in the diameter of the cylinders, or for the increase in piston speed which occurs with an increased stroke-bore ratio. The committee's formula is based on the results of tests on 144 actual engines, and is as follows:—

$$B.H.P. = 0{\cdot}45(d+s)(d-1{\cdot}18)N,$$

where d is the bore of the cylinder in inches, s the stroke of the piston in inches, and N is the number of cylinders.

WE are informed that, owing to an alteration in the publications, papers read before the Physical Society of London in future will appear, in general, only in the Proceedings of the society, and not in the *Philosophical Magazine*. The Proceedings and other publications are now obtainable by the public from the publishers to the society, *The Electrician* Painting and Publishing Company, Ltd., 1, 2, and 3 Salisbury Court, Fleet Street, London, E.C.

THE eighteenth report of the Leicester Museum and Art Gallery Committee to the Town Council for the year ended March 31, 1910, has been received. The long-projected extension and reconstruction of the museum and art gallery buildings have now been commenced. Important additions were made to the museum during the year; in the department of Coleoptera and economic entomology, a collection of 6000 specimens of 1300 species was presented by Mr. C. B. Headly, and 408 specimens of 356 species, chiefly from Leicestershire, were given by Mr. F. Bouskell.

OUR ASTRONOMICAL COLUMN.

NOVA LACERTÆ.—Several further notes on Nova Lacertæ appear in the *Astronomische Nachrichten*. In No. 4470 Prof. Pickering gives particulars concerning the earlier history of the star, according to the Harvard collection of photographs, and states that spectrum photographs by Mr. E. S. King showed eleven bright lines. Prof. Nijland gives the results of magnitude observations at Utrecht showing a gradual decrease in the nova's brightness from 7·40 on January 1 and 2 to 8·30 on January 16; the colour was fairly constant at 3·7, and is found to be similar to that of the long-period variables R Arietis, T Cassiopeiæ, and S Ursæ Maj. at their maxima. Photographic magnitude observations at Munich, reported by Dr. Kühl, agree with the above in showing a somewhat similar decrease over the same period

In No. 4471 Dr. Max Wolf gives the measures of the nova's position on plates taken on January 17 and in 1904, and raises the question whether the slight difference of 0·10s. in R.A. may be ascribed to proper motion.

Mr. P. M. Ryves has communicated to us his observations of the nova's magnitude, made at Zaragoza, Spain, between January 5 and February 5. The observations were made with a 3-inch telescope, Harvard and D.M. magnitudes being taken for the comparison stars, and show a steady decrease from 7·2 to 8·6 in the observed magnitudes.

A further note concerning the spectrum of the nova, as photographed at the Meudon Observatory, is contributed by M. Idrac to the *Comptes rendus* for February 6. Three fine nights, January 28–31, permitted him to secure photographs with from one to three hours' exposure on panchromatic plates. The very broad, bright hydrogen lines are seen to be divided into two components, of which the brighter show a "shift" of 7 Angströms towards the red, while the fainter are displaced 16 Angströms towards the violet; a dark line, possibly double, occurs on the violet side of Hγ. In the yellow there are three bright bands, at about λ 587·4 (probably helium, 587·6), λ 575·4, and λ 567·5, while the green shows a band, about 30 Angströms broad, having its centre near λ 500, and a bright line at λ 493·7. The band at λ 465, mentioned in the earlier communication, is shown to be multiple, having maxima at λ 462 and λ 466, with a fainter component at λ 470; the bright lines near λ 437·4 and λ 458·3 are also shown, but appear less marked than previously. Other maxima and minima mark the continuous spectrum, and are probably indicative of lines or bands beyond the separating power of the spectrograph; such maxima are well marked in the neighbourhood of λ 425 and λ 445. The presence of nebula lines in the spectrum is open to question, but the strong band near λ 500 suggests the possible presence of the chief nebula line; its great width, however, prevents any definite solution of the question; in fact, all the wave-lengths given may only be accepted as approximations.

EPHEMERIS FOR FAYE'S COMET.—To No. 4469 of the *Astronomische Nachrichten* Dr. Ebell contributes a daily ephemeris for Faye's comet, based on the elements published in No. 187 of the Lick Observatory Bulletins, and extending to March 27. At present the object is very near to π^2 Orionis, and is calculated to be a little fainter than the thirteenth magnitude; its motion is easterly, with a slight northern trend.

STANDARD ASTROMETRY.—An important suggestion as to the publication of results obtained in accordance with the scheme of the International Astrographic Conference is made by Mr. W. E. Cooke in No. 4470 of the *Astronomische Nachrichten*. This scheme embodies the observation of a definite list of fundamental stars by observatories equipped to carry out such work with the greatest possible accuracy. Other stars, *étoiles de rèpere*, will be connected with these by careful differential observations through a third set of stars employed as "intermediate standards." Mr. Cooke's suggestion is that while the differential observations should be made with the greatest possible accuracy, the results should be published in such a manner as to show the standards upon which each catalogued position depends.

The value of the suggestion is obvious. Although the international fundamental catalogue will probably be far superior to any now existing, future improvements in the standards are inevitable, and if Mr. Cooke's plan is followed, future observers will be able to reduce the individual published observations to the improved standards.

Mr. Cooke has followed this plan in vol. iv. of the Perth Observatory Meridian Observations, 31° to 33° S. (1900), recently received, and in an appendix he gives blank columns in which the corrections, dependent upon the future improvement of the places given in the "Perth Catalogue of Standard Stars, 1905·0," can readily be inserted.

NEW SPECTROSCOPIC BINARIES.—Lick Bulletin No. 182 gives the measures of a number of stars of which the radial velocities have recently been discovered to be variable. The following were discovered on plates secured at Santiago, generally with the two-prism instrument, and are described by Mr. J. H. Moore:—λ Hydri, γ Mensæ, ξ Columbæ, h^1 and h^2 Puppis, δ Antliæ, θ_1 Crucis, ξ^2 and h Centauri, and d Lupi; for h Centauri Mr. Paddock finds a period of about 16·7 days. Observations made during

©1911 Nature Publishing Group

1904–7 show that ζ Gruis is a binary with a range of velocity from −8·7 to +1·7 km.

Variations in the radial velocities of the following stars have also been detected from Lick and Santiago observations, and are reported by Prof. Campbell:—16 Aurigæ, o_2 Canis Maj., 12 Comæ Berenices, 4 Ursæ Min., *i* and 36 Ophiuchi, *f* Draconis, A Sagittarii, and α Cygni. In the case of *i* Ophiuchi, a plate taken on April 28, 1910, shows that the line at λ 4481 distinctly double, giving radial velocities of −77 km. and +9·2 km. for the two components. Fifteen plates of α Cygni, taken between August, 1896, and December, 1909, show that the variability of the velocity is not great, the range being from 0 to 7·9 km.

OBSERVATIONS OF JUPITER'S GALILEAN SATELLITES.—In No. 5 of the Transvaal Observatory Circulars, Mr. Innes gives an account of the observations of Jupiter's satellites made at the observatory during December, 1909, to August, 1910. The observations were made with the 9-inch refractor, and, in addition to the times of occultations and transits, remarks are added as to the appearance of the satellite, the phenomena of its disappearance or reappearance, and the appearance of various belts on the planet itself. Mr Innes records that on February 16, 1910, the final occultation of J III was long drawn out; whereas five-sixths of the satellite was occulted in 6½ minutes, the remaining one-sixth took another 6m. 10s. When half the satellite was occulted, the remaining half had the appearance of a close double star alongside Jupiter's edge. Satellites I and III were occasionally remarked to be oval rather than round, and several spots and markings were seen on their discs. An unpredicted partial transit of IV across the N. pole of Jupiter occurred on August 14, 1910.

A CONFIRMATION OF THE DISINTEGRATION THEORY.[1]

IT is probable that the transition from radium through the emanation to radium D involves the loss of four α particles, that is, four atoms of helium. The atomic weight of radium may now be taken to be 226·4, and if, on changing into niton, one α particle is lost, it is to be expected that the atomic weight of niton should be 222·4, for 226·4−4=222·4. But attempts to estimate the density of niton by determinations of its rate of diffusion have in most cases yielded the value 176 to 180, though Perkins, comparing the diffusion-rate with that of mercury vapour, obtained the value 235; and Debierne, using Bunsen's method of causing the gas to issue through a minute hole, arrived at the value 220. Undoubtedly the emanation belongs to the series of the inactive gases, and to complete the series—helium, 4; neon, 20; argon, 40; krypton, 83; and xenon, 130—there is room for two higher members with atomic weights 178 and 222·4.

It might happen that, in the disintegration of radium to niton, a non-radio-active substance might be produced of atomic weight 44; the change would then be:—radium (226·4)=helium (4)+(say) scandium (44)+niton (178·4).

The only certain method of ascertaining the molecular weight of a gas is the determination of its density; and in this case it is almost certain that the gas is monatomic, and that its molecular and atomic weights are identical. This constant has now been determined by the help of a balance closely resembling one recently described by Steele and Grant in the Proceedings of the Royal Society.

For details of the construction and use of the balance, the original paper must be referred to; suffice it to say here that its sensibility is about two or three millionths of a milligram. The weight is ascertained by the alteration of the pressure in the balance-case, thus altering the buoyancy of a small bulb of silica containing about 20 cubic millimetres of air, the weight of which is 0·027 milligram, or 27,000 millionths of a milligram.

A preliminary experiment, in which 0·0977 cubic millimetre of xenon was weighed, gave its weight as 578 millionths of a milligram instead of the calculated 577; it was thus shown that fairly good results might be expected in determining the density of the emanation.

[1] "The Density of Niton (Radium Emanation) and the Disintegration Theory." By R. Whytlaw Gray and Sir William Ramsay, F.R.S. Abstract of paper read before the Royal Society on January 12.

In a month, the emanation may be taken as having wholly changed into its degradation products, the chief of which is radium D; and an experiment was made in which a minute density-tube was left on the balance for three months before it was opened, evacuated, and reweighed. The loss was helium, and its weight was 27 millionths of a milligram; the calculated weight, on the assumption that the density of niton is 222·4/2=111·2, and that each volume of the emanation yields three volumes of niton on disintegrating, should have been 38 millionths. This helium, judging from previous experience, had probably penetrated the glass of the density-tube and been retained there. The tube was therefore heated *in vacuo*, and the evolved helium washed out with a cubic centimetre of oxygen; the gases were transferred to a measuring apparatus, and after absorbing the oxygen by charcoal cooled with liquid air, the helium was measured. Calculating the volume to weight, its weight must have been 8 millionths; and the sum of 8 and 27 gives 35, instead of the calculated 38 millionths of a milligram. A further proof is thus given of the conclusion drawn by Ramsay and Soddy from the measurement of the volume of niton, and of the helium into which it changes, that the latter is three times the former.

Five determinations of the density of niton were made; stated as atomic weights, the figures are:—227, 226, 225, 220, and 218; the mean is 223. This number is the one calculated on the assumption that when radium disintegrates, the only immediate products are niton and helium, 226·4=222·4+4.

In suggesting the name niton for the cumbrous expression "radium emanation," the authors point out that it is advisable to indicate by a similar name the fact that this gas belongs to the argon series; were its radio-active relations to be emphasised, as in the term "radium emanation," it would be necessary to rename radium as a derivative of uranium by some such name as would introduce the word uranium.

The authors regard the work as a further proof, if any were needed, of the beautiful disintegration theory of Rutherford and Soddy.

SAFETY LAMPS AND THE DETECTION OF FIRE-DAMP.

WE have received from the Home Office a leaflet and a card in a convenient form for carrying about in the pocket, upon which are shown, reproduced in colour, the appearances presented by the miner's lamp in the prescence of fire-damp. The difficulty of reproducing the appearances presented by a fire-damp "cap" in the safety lamp is very great, but it must be admitted that the illustrations issued by the Home Office are of a very high standard of excellence, whether considered from the artistic or from the technical point of view. Necessarily, these illustrations suffer from various defects: the Home Office does not state what class of lamp was employed or the nature of the oil burnt in it, and it is a well-known fact that these conditions influence greatly the nature and appearance of the cap. It is, for example, very well known that the Wolf lamp, burning benzene, is more sensitive than an ordinary Massant lamp burning, say, colza, or a mixture of colza and mineral oi .

We very much doubt whether one man in ten would be able to see 1½ per cent. of fire-damp, as indicated on the card, the lower limit of visibility with most men being about 2 per cent. It is, of course, well known that men's eyes differ very considerably in the power of seeing these faint caps, and the representations here given are of caps as they appear to a man whose eyesight is well developed by training and well fitted by nature for seeing these delicate phenomena. It is a pity that the Home Office has not directed the attention of miners more strongly upon the card, in the same way as it has done in its leaflet, to the danger attending far smaller proportions of fire-damp than the lamp can detect in the presence of coal-dust.

It is to be feared that the issue of the card without such a caution as we have referred to, will induce among miners the fixed opinion that they are perfectly safe so long as their lamp shows no cap. But it is well recognised that a

©1911 Nature Publishing Group