

The lens is placed immediately behind the screen, and the thin pencils of light which pass through the holes are received on a photographic plate placed at suitable points between the lens and its focus, and beyond the focus. From the subsequent measurements of the positions of the spots of light on the plate curves showing the variation of the effective focal length, the spherical aberration and the coma for each of the four kinds of light used are drawn. Seventeen sets of curves for typical lenses are reproduced in the paper.

THE Institution of Electrical Engineers has issued in pamphlet form the standard clauses for street lighting specifications which are the outcome of the deliberations of the Joint Committee consisting of delegates of the Institution of Electrical Engineers, the Institution of Gas Engineers, the Institution of County and Municipal Engineers, and the Illuminating Engineering Society, and appointed in 1910. The specification prescribes the form of tender, particulars of lighting units, and the general nature of the contract. It is proposed to classify streets in five classes, having respectively a minimum illumination of 0.01, 0.025, 0.04, 0.06, and 0.1 foot-candle, the minimum being measured with a suitable photometer in a horizontal plane 3 ft. 3 in. from the ground. A minority report expresses the dissent of the council of the Institution of Gas Engineers to the proposed basis of measurement, and it is preferred that contracts for street lighting should be based on the average candle-power of the light source ascertained at two or three prescribed angles. The points at issue were dealt with in the discussion of a paper on this subject by Mr. A. P. Trotter before the Illuminating Engineering Society in 1913, but complete agreement was not attained. As the matter has been under consideration for six years it was decided to publish the clauses as they now stand, accompanied by a minority report. It is hoped that they will be found useful when methods of street lighting are reviewed after the war. Copies can be obtained from the secretary of the institution, price 3d., post free 4d.

THE relation between temperature and the pressure of a saturated vapour is of great theoretical and practical interest, and a very extensive literature already exists on the theoretical side, special attention having been given to the relationship in the case of water and water vapour, and ice and vapour. So far as the vapour pressure of ice is concerned, experimental determinations have been carried out with considerable accuracy in recent years by Scheel and Heuse and others, but there has been a great need for a series of exact determinations of the vapour pressure of ice at low temperatures, in order partly to correct the values obtained by Scheel and Heuse, and partly to see whether the Nernst formula holds good down to the lowest pressures. Such a series of determinations has been carried out with the greatest care by Sophus Weber, working in the laboratory of Prof. Kammerlingh-Onnes at Leyden (Communications from the Physical Laboratory of the University of Leyden, No. 150). The method employed was the ordinary static method in combination with the absolute manometer and the hot-wire manometer of Knudsen. The measurements extend over a range of temperature from about -22° to -190° C., and the values have been compared with the Nernst formula,

$$\log p = \frac{-2611.7}{T} + 1.75 \log T - 0.00210 T + 6.5343.$$

The concordance has been found to be particularly good. By the introduction of a quantum-formula due to Pollitzer, Nernst has made his equation more rational, but so far as agreement with experiment is

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concerned, there appears to be little to distinguish the two expressions. Incidentally, it may be said, the experiments of Weber show that water vapour at a temperature of -80° has a molecular weight of about 20, whereby partial association is indicated.

THE customary methods for the preparation of plant nucleic acids are rather cumbersome and necessitate a peptic digestion of the nucleoproteins extracted. Messrs. G. Clarke and S. B. Schryver have succeeded in avoiding the peptic digestion, and their method of procedure is described in the *Biochemical Journal* for December. In the preparation of nucleic acid from yeast, the latter, after pressing, is treated with a large excess of 95 per cent. alcohol for twenty-four hours, and then boiled for two hours in the same solvent, whereby the protein-complex is rendered insoluble in sodium chloride solution. The yeast is then filtered, pressed, dried at 37° , ground to a fine powder, and extracted for four to five days with 10 per cent. sodium chloride solution at 60° - 80° . When the clear extract is treated with hydrochloric acid a characteristic precipitate of nucleic acid separates and settles to a hard cake at the bottom of the vessel. After standing, this is washed with 50 per cent. alcohol until free from chlorine, left standing overnight in 95 per cent. alcohol, and finally washed with absolute alcohol and ether. The yield varied from 1.4 to 1.6 per cent. of the dry alcohol-extracted yeast. The crude nucleic acid was best purified by dissolution in warm 10 per cent. sodium acetate solution, and reprecipitation with hydrochloric acid. Nucleic acid can be prepared from wheat embryos in a similar manner, but in this case it is found advantageous to remove the starch by hydrolysis with taka-diastase before extracting with sodium chloride solution.

OUR ASTRONOMICAL COLUMN.

INFRA-RED SOLAR SPECTRUM.—By the use of plates stained with dicyanin, Mr. W. F. Meggers, of the Washington Bureau of Standards, has obtained an excellent series of photographs of the solar spectrum in the region from 6800 Å to 9600 Å (*Astrophysical Journal*, vol. xlvii., p. 1). These photographs thus provide material for accurate determinations of wavelengths in continuation of the classic tables of Rowland, which did not extend further than the approximate limit of the visible spectrum at 7300 Å. Photographs in the same part of the spectrum of more than forty of the chemical elements have also been taken, and nearly 400 of the solar lines have been identified with lines in the spectra of eighteen elements. Two hundred lines are accounted for by iron, sixty-three by nickel, twenty-seven by titanium, twenty-two by cobalt, and smaller numbers by chromium, silicon, manganese, calcium, and other elements. One thousand six hundred lines remain for the present unidentified. In addition to the well-known bands due to terrestrial oxygen, there are others which appear to be due to water vapour. The separation of the solar and telluric lines has been undertaken at the Allegheny Observatory by the solar rotation method. Publication of the wavelengths is postponed, but reproductions of the solar photographs, with wave-length scales, are included in the paper.

HARVARD COLLEGE OBSERVATORY.—A recent report of the committee appointed to visit and report upon the Harvard College Observatory refers chiefly to the valuable services rendered by the director in promoting co-operation among astronomers. It is now about forty years since Prof. Pickering began to advocate the advantages of united efforts in carrying out some of the larger investigations in astronomy, and at the present time a considerable amount of the work of the

Harvard Observatory is carried on in co-operation with other institutions. Prof. Pickering has also assisted largely in the organisation of amateur astronomers in America, especially for the observation of variable stars, in which thirty observers are now associated. For this work the observatory has furnished suitable charts, and determinations of the magnitudes of nearly 5000 reference stars.

Harvard Circulars Nos. 203 and 204 have also been received. The first includes particulars of asteroids which will attain magnitude 10, or brighter, during 1918, and the second contains a valuable summary of the observed magnitudes of Nova Persei No. 2 from 1902 to the end of last year, together with a list of comparison stars suitable for future determinations.

THE CANADIAN "OBSERVER'S HANDBOOK."—A useful service to its members is rendered by the Royal Astronomical Society of Canada in the annual publication of "The Observer's Handbook." It includes a collection of astronomical data, referring especially to the sun, moon, and planets, arranged very conveniently in the form of a calendar. There is also a special list of occultations, calculated for Ottawa. Tables which vary but little from year to year have been omitted from the present issue.

EPIHEMERIDES OF ALGOL VARIABLES.—In the *Journal des Observateurs*, vol. ii., No. 4, M. Luizet has given a valuable series of tables, from which observers can readily prepare a list of the dates of occurrence during the present year of minima of 123 variables of the Algol type. The epoch of the first minimum occurring in each month is given in the first table, and the length of period, and multiples thereof, in the second. The variables are designated by the notation of André, as well as by that of Argelander.

THE TRAINING OF THE FRENCH ENGINEER.

IN the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale* for September-October last appears a valuable report of the proceedings of the Society of Civil Engineers of France concerning the training of engineers of the first rank, alike for the special services of the State and for leading positions in industry. Not only is the specialised training required considered in the article, but also the previous preparatory education. The matter arose on the presentation of an important communication from M. Léon Guillet, a member of the society, which was considered at a special session of the society held on November 3, 1916, at which the Minister of Commerce and Industry presided. The communication embraced a comparative study of the subject of technical training as it is pursued in France and abroad, a thoughtful criticism of the existing means and methods of such instruction and the preparation required for it, and an expression of personal views as to the lines upon which in future both preparatory and technical studies should proceed. A special commission was appointed, which sat during five sessions, extending to the end of April, 1917, and took important evidence from professional and other persons engaged in engineering.

An official invitation was received by the society in January, 1917, from the Minister of Commerce and Industry, to formulate proposals for the essential modifications required, in its opinion, to be introduced to ensure the more efficient education and training of professional engineers. These proposals take the form of recommendations relative to reforms in the aims and methods of secondary education, as a preparation for higher

technical schools, in which it is suggested that the classical studies should be lessened, the teaching of modern languages encouraged, and courses in manual exercises introduced. It is also suggested that the plan of instruction should be arranged so as to meet the needs on one hand of those proceeding to higher normal schools, and on the other of those entering the technical high schools.

Great importance is attached to the necessity for the fullest opportunity of laboratory practice in the technical high schools, and for the encouragement not only of a spirit of individual research and inquiry in the students, but also of a more intimate relation between them and the teaching body with less merely *ex cathedra* teaching. It is laid down as essential that the directing and teaching *personnel* of the engineering schools shall be recruited from persons actively associated with industrial conditions, and that the students themselves shall have had the opportunity of work in the factories and of travel-study in the workshops of France and in foreign countries. The vital importance of the economic aspect of industry is insisted upon, and with the view of increasing French influence abroad, every encouragement should be given to foreigners to follow in whole or in part the instruction in the technical high schools, and, finally, it is recommended that so far as possible the native pupils shall be admitted without fee, and assisted, where necessary, by loans without interest. It is suggested that regular military training shall be maintained in these schools, that the time spent in them shall count as two years in the Service, and that the one year of effective service shall consist of six months with the colours and six months in the service of the State or in industries susceptible of contributing to the national defence, or in camp instruction for officers.

Proposals are made for further specialised and advanced instruction of a post-graduate character, and after the manner of the newly founded High School of Electricity, it is suggested that institutions dealing respectively with machinery and iron and steel construction, metallurgy, chemistry, textiles, public works and railways, and naval construction should be established, and short technical courses of a very advanced character dealing with the most recent progress in technical science offered to professional engineers engaged in works. The proposals are further elaborated in a long communication from the vice-president of the society to the Minister of Commerce and Industry which is well worthy of the attention of the engineering profession in this country.

NEMATODE PESTS.

PROF. WARRINGTON YORKE and Dr. B. Blacklock (in *Annals of Trop. Med. and Parasitology*, vol. xi., No. 2, 1917) have recorded a series of interesting observations on the periodicity of the larvæ of the nematode worm, *Filaria bancrofti* (*nocturna*), in an Australian who contracted the infection in Queensland. It is well known that during the night the larvæ of this species are concentrated in the cutaneous vessels, while during the day they are present there in small numbers only. The authors estimated the number of larvæ in the cutaneous blood every two hours for a period of twenty-four hours on December 21-22, 1916, and again on January 5-6, 1917. The maximum concentration observed was at midnight, when there were 12,850 larvæ per cubic centimetre. Although the number of larvæ fell to a low level during the daytime they were never absent, the minimum number noted being 50 per c.c. of cutaneous blood. A discussion of the ob-