tional needs of the young men and women of South London are well provided for. The object of the classes is to provide sound instruction and to promote industrial skill and general knowledge. It is interesting to note that the trade classes are intended especially and only for those who are engaged in the several trades. Among such classes may be mentioned as typical those for motor drivers and repairers, motor engineers and designers, sanitary inspectors, men engaged in electrical and building industries, and bakers and confectioners. Special attention is paid also to the technical education of women, for whom a variety of trade classes has been arranged. Women are trained for home duties in a special department, and prominence is given to the scientific principles upon which successful domestic practices depend. The arrangements made for the coming winter are of a very complete character.

In the opening pages of the new calendar of the University College Hospital Medical School is an explanatory statement of the new arrangements for medical education consequent upon the formation by the University of London of university centres for instruction. Under these arrangements a student will enter one of the university centres for the preliminary and intermediate medical studies, and will then complete his career at the Hospital Medical School, the whole of the energies and resources of which will be devoted to a development of the medical studies proper. The calendar contains an engraving of the new buildings of University College Hospital, provided by the generosity of the late Sir Blundell Maple, which will be opened formally by H.R.H. the Duke of Connaught on November 6. Another engraving shows an elevation of the new medical school buildings erected through the munificence of Sir Donald Currie. These buildings are being specially constructed with laboratories and research rooms for medicine, surgery, pathology, and other departments.

A COMPREHENSIVE resolution referring to education was adopted last week at the Trade Union Congress at Liverpool. Among the points accepted by the congress as essential to a sound educational system are the following:—(1) scientific physical education with medical inspection and records of the physical development of all children attending State schools, and skilled medical attendance for any child requiring same; (2) a national system of education under full popular control, free and secular, from the primary school to the university; (3) secondary and technical education to be an essential part of every child's education, and to be secured by such an extension of the scholarship system as will place a maintenance scholarship within the reach of every child, and thus make it possible for all children to be full-time day pupils up to the age of sixteen; (4) the best intellectual and technical training to be provided for the teachers of the children; (5) the cost of education to be met by grants from the Imperial Exchequer, and by the restoration of misappropriated educational endowments.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 28.—"Researches on Explosives." Part iv. By Sir A. Noble, Bart., K.C.B., F.R.S.

In part iii. of his "Researches on Explosives" the author gave the results of a very extensive series of experiments on certain explosives, which were, first, the cordite of the Service, known as Mark I.; second, the modified cordite, known as M.D.; and third, the nitrocellulose, known as Rottweil R.R. The experiments made extended, for all the above explosives, from densities of 0.05 to 0.45 or 0.50, and pressures of from 2.75 tons per square inch (419 atmospheres) to pressures of 60 tons per square inch (9145 atmospheres).

In the present paper full details are given of three other explosives, and comparisons are made between them and the explosives which have been so much experimented with in this country. If reference be made to the tables, which cannot be given in this abstract, it will be seen how wide are the differences between the explosives, not only in the absolute volumes of the several gases, but in the variations with reference to the densities at which they were fired.

Thus, for example, comparing Norwegian 165 and Italian ballistites, while in the former the carbon monoxide commences at the density 0.05, with a percentage volume of 38.5, falling at a density of 0.45 to 22 per cent., the carbon dioxide commences with 13.3 per cent., rising rapidly to 31 per cent. In the latter explosive the CO commences at 20.5 per cent., and falls slowly to 15 per cent., while the CO₂ commences a little above 26 per cent., rising also comparatively slowly to nearly 34 per cent.

But there are, in these two explosives, other remarkable differences. Thus, in the Italian ballistite, at a density of 0.05, the volume of methane CH₄ is a mere trace, about 0.02 per cent., and it remains very much lower than is the case with any other explosive, being only 1.9 per cent. at the density of 0.45. With the Norwegian, on the other hand, the CH₄, although the volume at commencement is only 0.04 per cent., is, at 0.45 density, 11 per cent.

Again, as might be expected, from the large quantity of CH₄ found in the case of the Norwegian ballistite, the volume of hydrogen falls from more than 20 per cent. to about 9 per cent.; in the Italian the H rises from about 8 per cent. to about 10 per cent., falling slightly at higher densities.

In both explosives the N is practically constant at about 12 and 16 per cent. respectively, but there is a very great difference as regards the H₂O. In the Norwegian the H₂O is constant at 14 per cent., there being no greater difference than might be expected from errors of observation, while, in the Italian, the H₂O, which commences at density 0.05, with a volume of 29 per cent., falls at a density of 0.45 to about 24 per cent. No other explosive approaches the Italian ballistite in respect to the large volume of aqueous vapour formed, especially at low densities.

In the tables are given the volumes in cubic centimetres per gram of the permanent and total gases, and curves have been drawn representing for the six explosives the observations of these volumes. In the case of five of the explosives there is, with increasing density, a very considerable decrease in volume, but with the Italian ballistite, throughout the range of the experiments, there is hardly any change. Curves representing these volumes are concave to the axis of abscissæ.

In the tables are shown the units of heat, both for water fluid and water gaseous. Curves have also been drawn for the units of heat (water gaseous); the curves in this instance are all convex to the axis of abscissæ, and it may be noted that, where the volume of gas per gram is large, the units of heat are low, and that, where the volumes of gas are rapidly decreasing, the curves representing the amount of heat developed show a rapid increase.

The next point to be considered is, the data being as is shown in the tables, what temperature are we to assign to that generated by the explosion? With the view of studying the question, the author resorted to two methods:—(1) Knowing with very considerable accuracy the units of heat (water gaseous) generated by the explosion, and having determined approximately the specific heat of the gases, the temperature of explosion should be given by the equation

$$t = \frac{\text{gram units of heat}}{\text{specific heat}} \dots \dots \dots (1)$$

(2) Knowing also with considerable accuracy the pressure at any given density, and knowing the pressure p_0 when the volume of gas generated is reduced to the temperature of 0° C., and a pressure of 760 mm. of mercury, the temperature is given by the equation

$$t = \frac{p - p_0}{0.00367 p_0} \dots \dots \dots (2)$$

With reference to equation (1), the specific heat of CO₂ is a very important factor in this determination, and the recent researches of Messrs. Holborn and Austin upon the specific heat of gases at constant pressure at high temperatures having apparently shown that the specific heats given by Mallard and Le Chatelier for temperatures above 100° C. are considerably too high, the author has taken the figures given by the former physicists, which, it may be remarked, up to temperatures of 800° C., are confirmed by Langen.

The specific heats given are, as has been said, those for constant pressure, and to obtain those at constant volume it is necessary to divide by the constant k , connecting the specific heats of gases and vapours at constant pressure and constant volume.

The author gives the values he has used, (1) of the specific heats at constant pressure; these are taken either from Holborn and Austin's paper, or from Landolt, "Physikalisch Chemische Tabellen," 1905; (2) of the constant k ; these are all taken from Landolt, pp. 407-8; (3) of the specific heats at constant volume.

Gases, &c.	Specific heat, constant pressure	Value of k	Specific heat, constant volume
CO ₂	0.2986	1.282	0.232
CO	0.2425	1.401	0.173
H	3.4100	1.408	2.422
CH ₄	0.5922	1.316	0.450
N	0.2497	1.410	0.177
H ₂ O	0.4210	1.330	0.361

The specific heats calculated from the above data, of the gases generated by the explosion of the six propellants, are given in the tables embodying the results of the whole of the experiments for each propellant, and in the tables are also given the temperatures of explosion deduced from equations (1) and (2), and here again it must be remembered that the temperatures with which artillerymen are chiefly concerned are those due to densities varying approximately between 0.17 and 0.23.

The Italian ballistite, which from equation (1) shows the highest temperature, commences at the density of 0.05 with 4943° C., this temperature hardly varying at all until the density of 0.25 is reached, when it slowly but regularly increases to about 5000° C. at $d=0.45$. Cordite Mark I., commencing at 4742° C., with a very slight fall, is practically constant up to $d=0.30$, after which it rises somewhat rapidly to a temperature of 4921° C. at $d=0.45$, and to 5065° C. at $d=0.50$.

When, however, the temperatures given by equation (2) are reached some very remarkable differences are met with.

It is found that at the higher densities and pressures there is generally a very tolerable accordance in the temperatures obtained from the two formulæ, but as the density and pressure diminish the divergence becomes in all cases considerable, but very greatly more with the explosives which develop very high temperatures, and which give rise to large percentages of carbonic anhydride.

The only construction the author is able to put upon the close approximation of temperature given by the two formulæ at high densities and pressures, and the wide differences which exist in some of the explosives at low densities, is that at high densities dissociation of the carbonic anhydride is prevented by the very high pressure, and that the great difference between, for instance, Italian ballistite and nitrocellulose R.R. at, say, the density of 0.1, is due, firstly, to the difference of the temperature at which the nascent gases are generated, and, secondly, to the proportion of CO₂ which is subject to dissociation.

The theory submitted is as follows:—

The nascent gases are generated at temperatures approximately as given by equation (1).

Under the low densities and pressures at the very high temperatures with which we are concerned, the CO₂ and possibly some H₂O are partially dissociated, giving rise to the fall in temperature exhibited by the results obtained from equation (2) at low densities. At high densities, as already pointed out, the two equations give in some cases accordant results, in all cases tolerable agreement; it therefore appears to the author to be reasonable to suppose that the facts he has recorded are due to partial dissociation at low densities and pressures, which dissociation is prevented by the very high pressures ruling at densities of 0.40, 0.45, and 0.50.

As no free oxygen is ever found in the analyses in cooling down, any free oxygen due to dissociation must have recombined, and the heat lost by dissociation regained. The

re-combination must, however, be very gradual, as no discontinuity is observed in the cooling curves.

It is then pointed out that a certain amount of confirmation is given to the view taken by the fact that if the explosives be arranged according to the amount of heat generated, derived from equation (1), regard being also had to the amount of CO₂ found, it will be found that the differences between the two formulæ decrease approximately as the factors to which the author has referred decrease, and a table is given showing these differences.

"On the Julianiaceæ, a New Natural Order of Plants." By W. Botting Hemsley, F.R.S.

The Julianiaceæ comprise two genera and five species. They are resiniferous, tortuously branched, deciduous, dioecious shrubs or small trees, having alternate, exstipulate, imparipinnate leaves, from about one to three decimetres long, clustered at the tips of the flowering branches and scattered along the short barren shoots. The flowers are small, green or yellow-green, quite inconspicuous, and the males are very different from the females. The male inflorescence is a more or less densely branched axillary panicle or compound catkin, from 2½ cm. to 15 cm. long, with weak, thread-like, hairy branches and pedicels. The male flowers are numerous, 3 mm. to 5 mm. in diameter, and consist of a simple, very thin perianth, divided nearly to the base into four to nine narrow, equal segments, and an equal number of stamens alternating with the segments. In structure and appearance they are almost exactly like those of the common oak. The female inflorescence is similar in structure to that of the sweet chestnut, consisting of an almost closed, usually five-toothed involucre, borne on a flattened pedicel and containing three or four collateral flowers, of which the two outside ones are, perhaps, always abortive.

At the flowering stage, the female inflorescences, including the narrow flattened pedicel and the exserted styles, are about 2 cm. long, and, as they are seated close in the axils of the crowded leaves and of the same colour, they are easily overlooked. The female flowers are destitute of a perianth, and consist of a flattened, one-celled ovary, terminated by a trifid style and containing a solitary ovule. The ovule in both genera is a very peculiar structure. That of Juliania, in the flowering stage, is a thin, flat, obliquely horseshoe-shaped or unequally two-lobed body, about 2 mm. in its greatest diameter, attached to the base of the cell. At a little later stage, in consequence of unequal growth, it is horizontally oblong, nearly as large as the mature seed, that is, 6 mm. to 8 mm. long, and almost symmetrically two-lobed at the top. A vascular bundle or strand runs from the point of attachment to the placenta upwards near the margin into one of the lobes. In this lobe the embryo is tardily developed, and at this stage it is more or less enclosed in the opposite lobe, the relations of the two being as nozzle and socket to each other. It is assumed that the whole of this body, with the exception of the lobe in which the embryo is formed, is a funicle with a unilaterally developed appendage, which breaks up and is absorbed during the development of the ovule into seed.

The ovule of Orthopterygium is very imperfectly known, but the attachment appears to be lateral and the funicular appendage cup-shaped at the basal end, bilamellate upwards, and more or less enclosing the embryoniferous lobe.

The compound fruits of Juliania are samaroid in form, the wing being the flattened pedicel, at the base of which it disarticulates from the undifferentiated part of the pedicel. They vary from 4 cm. to 7 cm. in length by 1½ cm. to 2½ cm. in width. Externally they strongly resemble the samaroid pods of certain genera of Leguminosæ, notably those of Platypodium and Myroxylon. The involucre itself, of the largest fruits seen, is only about 1 cm. deep by 2 cm. wide. It is composed of very hard tissues, and is quite indehiscent. Only quite young fruit of Orthopterygium is known. In this the flattened pedicel is narrow, straight, and equilateral, from 6 cm. to 7 cm. long and about 1 cm. wide.

The nuts of Juliania are almost orbicular, biconvex, hairy on the outside, and have a very hard endocarp. The solitary exalbuminous seed is circular or oblong, 6 mm. to 10 mm. long, compressed, with a smooth, thin testa. The embryo is horizontal, with thin, plano-convex, more or less

oblique, obscurely lobed cotyledons, which are epigæous in germination, and a long ascending radicle applied to the edges of the cotyledons.

So far as at present known *Juliania* is confined to Mexico, and the various species occur in isolated localities between about 17° 40' and 23° N. lat., and 97° and 104° W. long., and at altitudes of about 1500 feet to 5500 feet.

The habitat of the Peruvian *Orthopterygium* Huaucaui is 2000 miles distant from the nearest locality of any species of *Juliania*. The exact position of the only place in which it has been found cannot be given, but it is in the Province of Canta, in the Department of Lima, between 11° and 12° S. lat.

PARIS.

Academy of Sciences, September 3.—M. A. Chauveau in the chair.—Observations of the Kopff comet made with the bent equatorial at the Algiers Observatory: M. F. Sy. Details of observations made on August 24 and 25. The comet appeared as a round nebulosity, with a nucleus, the lustre of which was comparable to a star of the twelfth magnitude.—Observations of the Kopff comet (1906e) made with the bent equatorial (32 cm.) of the Lyons Observatory: J. Guillaume. Results for six nights, August 26–31.—The growth of multiform functions: Georges Rémondos.—Description of an autocollimator level with a mercury horizon: MM. Claude and Driencourt. The description is accompanied with a diagram of the apparatus, for which a greatly increased accuracy is claimed. The determination of the melting points of the alloys of aluminium with lead and bismuth by means of thermoelectric pyrometers: H. Pécheux. The melting points were studied by two couples, platinum/10 per cent. platinum-iridium and nickel/copper. The temperatures given by each couple for eight alloys are stated, and the agreement is sufficiently good for the author to suggest that the nickel-copper couple may render good service for commercial uses.—The action of nascent hypiodous acid on unsaturated acids. Iodo-lactones: J. Bougault.—Starchy material studied with the aid of our knowledge of the colloidal state: G. Malfitano.—The isomorphism of northupite with tychite: A. de Schulten.

NEW SOUTH WALES.

Linnean Society, July 25.—Mr. Thomas Steel, president, in the chair.—The botany of north-eastern New South Wales: F. Turner. The paper gives a general account of the indigenous vegetation and of the exotic weeds of the country comprised between the New South Wales-Queensland border and 32° S. lat.; the S. Pacific on the east, and 152° 20' or 151° E. long. From a botanical point of view, the region in question is one of the most fertile and interesting sections of country in Australia, and a census of its semi-tropical flora is estimated to comprehend 734 genera and 1767 species.—A review of the New South Wales species of Halorrhagaceæ, as described in Prof. A. K. Schindler's monograph (1905), with the description of a new species: J. H. Maiden and E. Bêche. The paper contains a list of New South Wales species of Halorrhagaceæ, showing the important changes made by Prof. Schindler, and gives description of a new species, *H. verrucosa*, from Woodburn, Richmond River, the specific name being given from the character of the fruit. Its nearest ally in Schindler's classification is *H. tenuis*, and in Benthams' *H. micrantha*, R.Br.—Notes on the hymenopterous genus *Megalyra*, with descriptions of new species: W. W. Froggatt. A general account of the members of this curious genus of parasitic Hymenoptera is given, with notes on the species previously described, their general structure, and the longicorn beetles the larvæ of which they parasitise. Eight new species are added to the seven previously described from Australia.—Description of a new tick of the family Argasidæ: W. W. Froggatt. The common "fowl-tick," *Argas americanus*, has been acclimatised in Australia for more than twenty years. An indigenous species is now described. This Argasid is common in the clay nests of the fairy martin, *Petrochelidon (Lagenoplatys) ariel*, and is usually to be found under the lining of feathers and grass resting against the clay in the nests containing the young birds, and for some time after the nestlings have flown.—The life-history of *Lestes leda*: R. J. Tillyard. The species is shown to be double-

brooded. The male assists the female in the act of oviposition, seizing her round the neck. The method of oviposition is discussed, and various statements that have been made by different entomologists from time to time are shown to differ from the results of observations on this species.

CALCUTTA.

Asiatic Society of Bengal, August 1.—Bibliomancy, divination, superstitions amongst the Persians: Lieut.-Colonel D. C. Phillott.—*Gentiana Hügelii*, Griseb., re-described: Dr. Otto Stapf. In 1835 Baron Karl von Hügel collected this gentian in Kashmir, and the specimens are preserved at Vienna. They have never been examined by writers on Indian gentians, and because Grisebach did not describe them quite accurately the species has never been fully understood. A new description is therefore necessary, and is offered with illustrations.—*Swertia angustifolia*, Ham., and its allies: I. H. Burkill. An account of *Swertia angustifolia*, with *pulchella* and *affinis*, *S. corymbosa*, *S. zeylanica*, and the whole of their close alliance, based on an examination of all the material available at the herbaria at Kew, at the Natural History Museum, South Kensington, at the Jardin des Plantes, Paris, and at Shibpur, Saharanpur, Madras, and Peradeniya, Ceylon. Some of the species defined are used medicinally for the true Chiretta.—Notes on some rare and interesting insects added to the Indian Museum collection during the year 1905–6: C. A. Palva. Notes on specimens, chiefly of Hymenoptera and Hemiptera, collected in Calcutta and the Darjiling and Purneah districts, together with a list of the Hymenoptera received from the Seistan Boundary Commission.—*Bulbophyllum Burkilli*: a hitherto undescribed species from Burma: Captain A. T. Gage. A description of a new *Bulbophyllum* from the Burmo-Siamese frontier, Tenasserim, which has flowered in the Royal Botanic Garden, Shibpur.

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