THE current number of the *Monthly Review* contains an article on public school education by Mr. A. C. Benson, in which some valuable testimony as to the inadequacy as a training for life of a purely classical education is given. The question as to what are the intellectual accomplishments of a boy of average intelligence who has been through a public school and a university is answered in the following words:—"He knows a very little Latin and Greek, and he endeavours to put them out of his mind as fast as he can; he knows a little science; perhaps a little history, mostly ancient. He cannot generally calculate correctly in arithmetic; he knows no modern languages to speak of; he cannot express himself in simple English, and his handwriting is often useless for commercial purposes." And later, we read, "he has learnt to think the processes of the mind dreary and unprofitable, to despise knowledge, to think intellectual things priggish and tiresome." Mr. Benson summarises his contentions in the following words:—"believing intensely, as I do, in the possibilities of intellectual education, I have tried to judge the classical system as fairly as I can by results, and I see that those results are in many cases so unsatisfactory and so negative that experiments are urgently needed. Simplification seems to me to be the one essential thing." If a writer who was formerly a master at our greatest public school finds it necessary to write in this plain manner, it is evidently high time that scientific methods were applied to obtain an answer to the question, what constitutes a suitable public school education, and how can it be secured?

A LARGE audience assembled at the Borough Polytechnic Institute on Monday evening, December 4, on the occasion of the thirteenth annual meeting and distribution of prizes and certificates. The chairman, Mr. Leonard Spicer, said the work of the institute was going forward with great strides, and he feared that, even allowing for the additions to the building which had recently been made, the governors would again be faced with the problem of knowing how to house the students. Although the word "polytechnic" is still associated in many minds with recreation and amusements, the chief work of institutes of this kind lies in an educational and technical direction, 15,000*l.* a year being the least sum upon which the work at the Borough can be carried on at present. Mr. C. T. Millis, the principal, read the annual report, which disclosed a very satisfactory state of progress of the institute. An experiment is being made in the direction of coordination with London County Council evening schools, and several new classes have been started. A satisfactory feature of the work of the institute is the readiness with which intending students ask for and follow advice given as to their courses of study, and the increasing number of students who attend for two, three, and four years. After the certificates, which numbered considerably more than five hundred, and the numerous prizes were distributed by Lady Lockyer, Sir Norman Lockyer, K.C.B., delivered an address. In a few remarks, Prof. Perry claimed for the polytechnic institutions of London that they were doing a work that was unprecedented, and which our colonies are now endeavouring to imitate. He had recently returned from South Africa, where he found the people following the lead which London was now giving in the matter of technical education. Votes of thanks were proposed and seconded by Sir Philip Magnus and Mr. W. F. Sheppard.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 16.—"The Electrical Conductivity of Dilute Solutions of Sulphuric Acid." By W. C. D. **Whetham**, F.R.S.

The equivalent conductivity of neutral salts when dissolved in water approaches a limiting value as the dilution is increased; with solutions of acids and alkalies, however, the equivalent conductivity reaches a maximum, and then falls rapidly as the dilution is pushed farther.

It has been supposed that this diminution of equivalent conductivity at extreme dilutions is due to interaction between the solute and the impurities which remain even in re-distilled water.

Kohlrausch has given evidence to show that the chief impurity in water carefully re-distilled is carbonic acid, and Goodwin and Haskell conclude that the diminution of equivalent conductivity of dilute acids is due to the presence of carbon dioxide.

In order to examine the real effect of carbonic acid and other impurities on the conductivity of an acid solution, the writer and his wife have carried out an investigation in which the amount of impurity was varied, and the result observed. The conductivity of dilute solutions of sulphuric acid and its variation with concentration was determined in four solvents:—(1) good quality re-distilled water; (2) the same water to which a trace of carbon dioxide had been added; (3) the same water with a trace of potassium chloride; (4) the same water which had been freed as far as possible from carbonic acid and other volatile impurities by repeated boiling under diminished pressure.

In each case the conductivity of the solvent was subtracted from that of the solution. The results may be summarised as follows:—

Within the limits of experimental error, the equivalent conductivity of a dilute acid is not affected by boiling the water under diminished pressure, though the conductivity of the solvent is thereby much diminished. The equivalent conductivity of the acid is also unaffected by the addition of a small quantity of potassium chloride to the water, though the conductivity of the solvent is thereby much increased. But, by the addition of a little carbonic acid, the equivalent conductivity of the sulphuric acid is diminished appreciably. It is natural to conclude that, while the presence of carbonic acid would produce a diminution of equivalent conductivity of the same character as that observed it does not explain the total effect.

"The Accurate Measurement of Ionic Velocities." By Dr. R. B. **Denison** and Dr. B. D. **Steele**. Communicated by Sir William Ramsay, K.C.B., F.R.S.

The authors have succeeded in devising an apparatus with which it is possible to compare and measure the velocities of the ions of a given salt without using gelatin or other membrane during the actual experiment. This enables the method of direct measurement of ionic velocities to be extended to dilute solutions, and the results obtained are free from any error due to electric endosmose.

The transport number and the average absolute velocity of the ions of a number of salts have been measured at dilutions down to one-fiftieth normal, and at two temperatures, 18° C. and 25° C. It is easy to measure by this method the transport number of the ions of some salts which present great difficulty by the analytical method of Hittorf, *e.g.* $KClO_3$, $KClO_4$, $KBrO_3$. The following are some of the numbers obtained for the anion transport number:—KCl $n/10$, 0·508; NaCl $n/10$, 0·618; KCl $n/50$, 0·507; $CaCl_2$ $n/50$, 0·587. The corresponding numbers determined by the analytical method are 0·508, 0·617, 0·507, 0·59.

The values obtained by the authors for the average velocity of the ions in cm./sec. agree in a remarkable manner with those calculated by Kohlrausch from conductivity data, and form a striking confirmation of the ionic theory of solutions. The values of the ionic velocity of the potassium ion in KCl, KBr, and KI are, for example, found to be:—at $n/10$, 0·000563, 0·000562, 0·000564 cm./sec.; at $n/50$, 0·000606, 0·000598, 0·000599 cm./sec. at 18° C.

It is claimed that the method is at least as accurate as that of Hittorf, and an experiment can be performed in about one-tenth of the time. It also gives a means of comparing the degree of dissociation of salts containing a common ion.

Mineralogical Society, November 14.—Prof. H. A. Miers, F.R.S., president, in the chair.—The determination of the angle between the optic axes of a crystal in parallel polarised light: Dr. J. W. **Evans**. The crystal plate is rotated on the optic normal as axis, and the positions are determined in which the relative retardation is nil. This may be observed by using a gypsum plate or the double quartz wedge devised by the author. In the latter case the positions in question are marked by the coincidence of the bands in the two halves of the wedge. This gives a very exact reading if strictly parallel light be employed.—Mineralogical notes (diopside and albite): Prof. W. J. **Lewis**. A large tabular crystal of white diopside, a brown

diopside of unusual habit, and a Carlsbad twin of albite were described.—Note on the crystallisation of drops, especially of potash-alum: J. **Chevalier.** The president described observations made by Mr. Chevalier on the crystallisation of drops of solution of potash-alum. These generally yield in succession (*a*) birefringent spherulites; (*b*) octahedra; and (*c*) a fine rectangular network. (*a*) is probably a less hydrated alum, and it becomes isotropic on exposure to moist air by conversion into (*b*). (*c*) is ordinary alum which is in a state of strain, owing to its rapid crystallisation, and becomes white and opaque after a time owing to the development of cracks. Drops observed upon a slide under the microscope behave differently according as they are in the metastable or labile condition. A metastable drop inoculated with (*a*), (*b*), or (*c*) deposits octahedra. A labile drop inoculated with (*a*) deposits spherulites, but inoculated with (*b*) or (*c*) deposits the rectangular network. When a metastable drop containing either octahedra or spherulites, or both, passes into the labile condition (by cooling or by evaporation), they may continue to grow unchanged. If, however, a fragment or germ of octahedral alum be introduced into a labile drop the network (*c*) is immediately produced. An alum crystal growing in a labile solution is surrounded by a zone of metastable liquid which prevents it from starting the network (*c*) characteristic of a labile drop. Experiments were made upon the action of various mineral substances in inducing crystallisation in metastable and labile drops. Among these the holosymmetric cubic crystals, and especially galena, exercise a remarkable effect in producing the network (*c*) in labile drops.—Note on the formation of gypsum crystals in a disused well at chemical works: C. J. **Woodward.** Groups of gypsum crystals were exhibited which were found thirty years ago studding the walls of an old well at Messrs. Chance's chemical works at Oldbury.—Notes on minerals recently found in the Binnenthal: R. H. **Solly.** The minerals described were (1) Ilmenite, in brilliant crystals, displaying marked hemihedrism and showing five new forms. It is associated with quartz, adularia, magnetite and mica, on mica schist. (2) Seligmannite; an exceptionally large and well developed crystal in dolomite. Unlike any previously described, it is untwinned; altogether forty-five forms were observed, of which twenty-one are new. (3) Marrite; two more crystals of this rare mineral were found, one tabular and the other sharply pointed in habit. (4) Proustite; a minute crystal deposited on a crystal of rathite. (5) Trechmannite; a crystal of this rare mineral displaying asymmetric hemihedrism, deposited on a crystal of binnite. (6) Hyalophane; in crystals of an unusual green colour.

Entomological Society, November 15.—Mr. F. Merrifield, president, in the chair.—*Exhibitions.*—A flower-frequenting beetle from the Transvaal, illustrating a remarkable device for the cross-fertilisation of flowers, one of the front feet being tightly clasped by the curiously formed pollinia of an Asclepias: Mr. **Arrow.**—A remarkable specimen of *Agrotis tritici,* taken this year at Oxshott, bearing a close resemblance to *A. agathina,* with which it was flying over heather: W. J. **Kaye.** The specimen was a good example of syncryptic resemblance brought about by the common habit of resting on heather.—A specimen of *Forficula auricularia* taken by Mr. R. A. R. Priske at Deal in September, 1905, having the left cercus normal, while the right was that of var. *forcipata*: W. J. **Lucas.**—Forms of South African Pierine butterflies taken during the dry season of the present year, together with specimens of the same species for comparison taken in the same localities: Dr. F. A. **Dixey.** He said that his exhibit illustrated the fact, now widely recognised, that these forms varied in general correspondence with the meteorological conditions prevailing at the different seasons.—A long series of *Hemerophila abruptaria* bred by the exhibitor illustrating the proportion of light and melanic forms derived from a light male and a light female: E. **Harris.**—A ♂ specimen of *Tortrix pronubana,* Hüb., taken by Mr. Harold Cooper at Eastbourne, either at the end of September or the beginning of October last: S. **Image.** The insect is new to the British list.—*Paper.*—Hymenoptera-Aculeata, collected in Algeria, part iii., Diploptera, by E. Saunders, F.R.S.: Commander J. J. **Walker.**

Linnean Society, November 16.—Mr. C. B. Clarke, F.R.S., vice-president, in the chair.—*Exhibitions.*—Specimens of British water Ranunculi, showing the modifications in the form of the leaves: H. and J. **Groves.** The authors pointed out that the species might be roughly grouped under three headings:—(1) those in which only broadly lobed aërial leaves were produced; (2) those in which submersed multifid leaves with capillary segments were also produced; and (3) those with multifid leaves only.—Photograph showing, of the natural size, the otoliths from thirty-five species of fishes, a collection made by the late Dr. David Robertson: Rev. T. R. R. **Stebbing.**—Leaf and seed of *Macrozamia spiralis* from Queensland, where the plant is stated to cause symptoms of paralysis of the hind-quarters of cattle eating the leaves: E. M. **Holmes.** The chemical nature of the constituents of the plant appears to be unknown.—*Papers.*—Contributions to the embryology of the Amentiferæ, part ii., *Carpinus Betulus*: Dr. Margaret **Benson,** Miss E. **Sanday,** and Miss E. **Berridge.** Material was collected early in July, 1902, and 1904, and more than 600 series of sections were obtained through ovules containing the earlier stages in the development of the embryo-sacs, until the first segmentation of the definitive nucleus had occurred. Former observations (see part i. in *Trans. Linn. Soc.,* ser. ii., bot. iii. (1894), pp. 409–424) were confirmed, and the following new facts obtained. The polar nuclei meet at the neck of the cæcum, descend together, and generally fuse near its base. The pollen-tube enters the sac in their vicinity, and emits one gamete into the cæcum, usually by means of a short spur. The gamete then makes its way to the definitive nucleus. The other gamete is carried up by the tube to the egg, with which it fuses. The egg then becomes clothed with a wall, and segmentation commences.—The membranous labyrinth of five sharks: Prof. C. **Stewart,** F.R.S.

PARIS.

Academy of Sciences, December 4.—M. Troost in the chair.—Contribution to the study of the distribution of the tsetse fly in French West Africa: A. **Laveran.** Since writing the earlier notes on the same subject, the author has accumulated additional material, details of which are now given.—On the deformation of quadrics: C. **Guichard.**—On Bode's law and the inclinations of the planetary equators to the ecliptic: E. **Belot.**—On the intrinsic brightness of the solar corona during the eclipse of August 30, 1905: Charles **Fabry.** The instrument used was a modified Mascart photometer. The intrinsic brightness found was, at a distance of 5′ from the edge of the sun, and in the direction of the equator, about 720 candles per square metre, or about 0·28 the intrinsic brightness of the lunar surface.—The inertia of the electrons: Marcel **Brillouin.**—On certain experiments relating to the ionisation of the atmosphere, executed in Algeria on the occasion of the total eclipse of August 30, 1905: Charles **Nordmann.** A continuous record of the positive ions present in the air was obtained, the instrument destined to measure the amount of negative ions being broken in transit. The curve given by the ionograph showed a marked minimum during the eclipse, thus agreeing with the views of Lenard, Elster and Geitel, who regard the solar radiation as one of the direct or indirect factors in atmospheric ionisation.—On the equilibrium diagram of the iron-carbon alloys: Georges **Charpy.** The influence of the rate of cooling on the composition of the casting has been neglected by the earlier workers on this subject. Details are given of a study of an alloy containing 2·90 per cent. of carbon, for which the Bakhuis-Roozeboom diagram is drawn.—The action of silicon on pure aluminium; its action on impure aluminium; silico-aluminides: Em. **Vigouroux.** Silicon does not form a definite compound with pure aluminium, but in presence of a third metal silicides of aluminium and this metal are formed, well defined crystallised substances, silico-aluminides.—On α-decahydronaphthol and the octahydride of naphthaline: Henri **Leroux.** α-Naphthol, treated with hydrogen by the method of Sabatier and Senderens, gives the decahydride, the details of the preparation and properties of which are given in the present note. Treated with a dehydrating agent it loses a molecule of water and gives an octahydride of naphthalene.—On victorium and the

ultra-violet phosphorescence of gadolinium: G. **Urbain.** The phosphorescence spectrum is given by one element when small quantities of a second element, called the excitor, are present. Either of these, in the pure state, gives no phosphorescent spectrum. These considerations have been applied to the examination of gadolinium, and the author regards the spectrum attributed to a new element, victorium, by Sir W. Crookes as due to a complex containing gadolinium.—On the existence of caoutchouc in a genus of Menispermaceæ: Jacques **Maheu.**—On prulaurasine, a crystallised cyanhydric glucoside extracted from the leaves of the cherry laurel: H. **Hérissey.** The method of obtaining this glucoside in a pure crystallised state from the leaves is given. Its formula appears to be $C_{14}H_{17}NO_6$, and under the action of emulsin it is hydrolysed to hydrocyanic acid, glucose, and benzoic aldehyde. It is an isomer of the amygdonitrile-glucoside of Fischer and the sambunigrin of Bourquelot and Danjou.—On the retrocerebral organ of certain rotifers: P. Marais **de Beauchamp.**—On phototropism of the larvæ of the lobster: G. **Bohn.**—On the geological structure of the eastern Pyrenees: Pierre **Termier.**—On the orientation which an elongated body will take when turning in a current of fluid: E. **Noël.**—On the Devonian fossils of the eastern Ahenet collected by M. Noël Villatte: Émile **Haug.** The collection of fossils made in the course of the Laperrine expedition is sufficient to prove the presence of the three principal subdivisions of the Devonian system, but the stratigraphical relations between the different terms cannot be exactly made out.—The influence of the summer rains on the yield of springs in the plains: M. **Houllier.**—The magnetic effects of lightning on volcanic rocks: Gaetano **Platania** and Giovanni **Platania.**

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 14.

ROYAL SOCIETY, at 4.30.—An Investigation into the Structure of the Lumbo-sacral-coccygeal Cord of the Macaque Monkey (*Macacus sinicus*): Miss M. P. Fitzgerald.—On the Distribution of Chlorides in Nerve Cells and Fibres: Prof. A. B. Macallum and Miss M. L. Menten.—The Mammalian Cerebral Cortex, with Special Reference to its Comparative Histology. I. Order Insectivora: Dr. G. A. Watson.—Observations on the Development of Ornithorhynchus: Prof. J. T. Wilson and Dr. J. P. Hill.—Further Work on the Development of the Hepatomonas of Kala-Azar and Cachexial Fever from Leishman-Donovan Bodies: Dr. L. Rogers.—The Action of Anæsthetics on Living Tissues. Part I. The Action on Isolated Nerve: Dr. N. H. Alcock.—Report on the Psychology and Sociology of the Todas and other Indian Tribes: Dr. W. H. R. Rivers.—On the Sexuality and Development of the Ascocarp of *Humaria Granulata*, Quel.: V. H. Blackman and Miss H. C. I. Fraser.—On the Microsporangia of the Pteridospermeæ with Remarks on their Relationship to Existing Groups: R. Kidston, F.R.S.—The Araucarieæ, Recent and Extinct: A. C. Seward, F.R.S., and Miss S. O. Ford.—On the Spectrum of the Spontaneous Luminous Radiation of Radium. Part IV. Extension of the Glow: Sir William Huggins, K.C.B., O.M., F.R.S., and Lady Huggins.

MATHEMATICAL SOCIETY, at 5.30.—On Well-ordered Aggregates: Prof. A. C. Dixon.—Tables of Coefficients for Lagrange's Interpolation Formula: Col. R. L. Hippisley.—On the Representation of certain Asymptotic Series as Convergent Continued Fractions: Prof. L. J. Rogers.—On a New Cubic Connected with the Triangle: H. L. Trachtenberg.—Some Difficulties in the Theory of Transfinite Numbers and Order Types: Hon. B. A. W. Russell.—The Imaginary in Geometry: J. L. S. Hatton.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—*Adjourned Discussion*: The Charing Cross Company's City of London Works: W. H. Patchell.

FRIDAY, DECEMBER 15.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—*Adjourned Discussion*: The Seventh Report to the Alloys Research Committee: On the Properties of a Series of Iron-Nickel-Manganese-Carbon Alloys: Dr. H. C. H. Carpenter, and Messrs. R. A. Hadfield and Percy Longmuir.—*Paper*: Behaviour of Materials of Construction under Pure Shear: E. G. Izod.

PHYSICAL SOCIETY (at Royal College of Science, South Kensington), at 7.—Exhibition of Electrical, Optical and other Physical Apparatus.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Tests of Street Illumination in Westminster: E. E. Mann.

AËRONAUTICAL SOCIETY, at 8.—The Acoustical Experiments carried out in Balloons by the late Rev. J. M. Bacon: Miss Gertrude Bacon.—The Aëromobile: F. Webb.—A New Continuous Impulse Petrol Motor for Dynamic Flying Machines: W. Cochrane.

MONDAY, DECEMBER 18.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Anthropogeographical Investigations in British New Guinea: Dr. C. G. Seligmann and Dr. W. Mersh Strong.

SOCIETY OF ARTS, at 8.—The Measurement of High Frequency Currents and Electric Waves: Prof. J. A. Fleming, F.R.S.

INSTITUTE OF ACTUARIES, at 5.—Canadian Vital Statistics; with Particular Reference to the Province of Ontario: M. D. Grant.

TUESDAY, DECEMBER 19.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Economy in Factories: H. A. Mavor.

ANTHROPOLOGICAL INSTITUTE, at 8.15.—The Origin of Eolithic Flints by Natural Causes: S. H. Warren.

ROYAL STATISTICAL SOCIETY, at 5.—The Decline of Human Fertility in the United Kingdom and other Countries as shown by Corrected Birth-Rates: Dr. Arthur Newsholme and Dr. T. H. C. Stevenson.—Changes in the Marriage- and Birth-Rates in England and Wales during the Past Half-century, with an Inquiry as to their Probable Causes: G. Udny Yule.

WEDNESDAY, DECEMBER 20.

GEOLOGICAL SOCIETY, at 8.—(1) The Clunian Series of the Ludlow District.—Miss G. L. Elles and Miss I. L. Slater; (2) The Carboniferous Rocks of Rush (County Dublin): Dr. C. A. Matley, with an Account of the Faunal Succession and Correlation by Dr. A. Vaughan.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Kite Observations from a Trawler in the North Sea: G. C. Simpson.—Investigation of the Upper Air in the West Indies by Means of Kites: C. J. P. Cave and W. H. Dines, F.R.S.—Temperature Observations during the Partial Solar Eclipse, August 30, 1905: W. H. Dines, F.R.S.—Comparison between Glaisher's Factors and Ferrel's Psychrometric Formula: J. R. Sutton.—A Rapid Method of finding the Elastic Force of Aqueous Vapour, &c., from Dry and Wet Bulb Thermometer Readings: Dr. J. Ball.

SOCIETY OF ARTS, at 8.—The Aërograph Method of Distributing Colour: Charles L. Burdick.

ROYAL MICROSCOPICAL SOCIETY, at 8.—A "Fern" Fructification from the Lower Coal-measures of Shore, Lancashire: D. M. S. Watson.—Exhibition of Balsam mounted Slides by the late Andrew Pritchard.

SOCIOLOGICAL SOCIETY, at 8.—The Russian Revolution and its Consequences: Dr. G. de Wesselitsky.

THURSDAY, DECEMBER 21.

LINNEAN SOCIETY, at 8.—Report on the Vienna Botanical Congress: Dr. A. B. Rendle.—*Cyrtandraceae malayanae novae*: Dr. Franz Kränzlin.—On Characæ from the Cape, collected by Major A. H. Wolley-Dod: H. and J. Groves.—Note on the Distribution of Shortia, Torr and Gray: B. Daydon Jackson.

CHEMICAL SOCIETY, at 8.30.—The Relation of Position Isomerism to Optical Activity. Part V. The Rotation of the Menthyl Esters of the Isomeric Dibromobenzoic Acids: J. B. Cohen and I. H. Zortman.—Azo-derivatives from α-Naphtho-methylcoumarin: J. T. Hewitt and H. V. Mitchell.—The Supposed Identity of Dihydrolaurolene and of Dihydro-*iso*laurolene with 1:1-Dimethylhexahydrobenzene: A. W. Crossley and N. Renouf.—The Slow Combustion of Carbon Disulphide: N. Smith.

CONTENTS.