AN ITALIAN ELECTRIC RAILWAY.

THE motive power on our great railways forms such an important question that any enterprise made with a new motive power, electricity or otherwise, adapted so as to utilise the existing rolling-stock, not only may at some future time greatly accelerate the present speed, but also introduce great economies, especially if the new power can be derived from a natural source. In Italy the railway authorities have been thoroughly alive to this fact; a portion of the railway of northern Italy has been electrically equipped for running by means of electric motors, as a pioneer installation, and if successful the remainder will be similarly equipped. The Valtellina electric railway (says *Feilden's Magazine* for January), which is sixty-two miles long, runs from Lecco along the shores of Lake Como to Colico, where it divides, one branch going to Sondrio and the other to Chiavenna. The power of the line is furnished by falling water from the river Edda, which operates four turbines (2000 h.p. each) and which, coupled direct with four Schubert three-phase generators, give a current at 20,000 volts and 15 cycles. This current is led to ten substations (placed about six miles apart) along the route, where it is transformed to 3000 volts, at which voltage the various sections of the line are fed. The two overhead trolley wires which supply the motors (the railway track forming the third) are hung from steel wires supported on each side by posts spread with crossbeams; these also carry the main supply wires (20,000 volts). The traffic of the line comprises both goods and passenger, and it is worthy of note that for the former electric locomotives are used for the haulage of the wagons (which are of the standard Italian type), and for the passenger traffic bogie motor-cars act in place of locomotives and pull four coaches as trailers (these latter also of the ordinary Italian type). A train of this description is run at thirty-nine miles per hour on all gradients less than 10 per cent.; for anything steeper than this "the Cascade" arrangement of motors is used, then the speed is halved. The speed of the goods traffic is twenty miles per hour with a load of 250 tons. The line is equipped with every facility for safe working, everything being made as automatic as possible. For instance, "when a train receives a block signal it also has its current cut off so that it cannot proceed." Again, "where a train is coming up at full speed, and it is necessary to order it to stop owing to sudden occurrence of something in front, the signalman not only makes the signal to stop, but he also cuts off the current and applies the full brake power available to the advancing train." Lightning has been fully guarded against. The power house is supplied with a group of conductors of the "Horn" type outside the building, and lightning arresters of a similar type are fitted in the substations, and, lastly, the electric locomotives and motor-cars have also similar apparatus fitted. The working of the line will not only be watched with interest, but also forms an important example of electric traction on account of its newness in design (especially in detail), and the thorough way in which the system is made automatic and interlocking and also safely guarded against accidents.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. W. E. Johnson, of King's College, has been appointed the first Sidgwick lecturer in moral science.

The Balfour studentship in animal morphology will be vacant at Lady Day next. Applicants are requested to send their names, with such information as to their qualifications and proposed researches as they may think desirable, to Mr. J. W. Clark, Scroope House, Cambridge, by February 28.

The complete degree of M.A. *honoris causa* is to be conferred on Dr. W. E. Dixon, London, assistant to the Downing professor of medicine.

THE proposal to establish a University of Liverpool was warmly supported at a meeting held at the Liverpool Town Hall on Monday, the Lord Mayor of the city being in the chair. At the close of the meeting it was announced that the sum of 80,0000*l.* has been promised in support of the scheme.

THE Lord Lieutenant of Berks (Mr. J. Herbert Benyon) has been elected president of Reading College, in succession to the late Lord Wantage. A fund of 1000*l.* a year for five years has been raised to augment the existing income. Lady Wantage, Mr. Benyon and Mr. Alfred Palmer have each contributed 250*l.* a year to this fund.

IT is proposed to erect a bronze tablet in the museum at Marischal College, Aberdeen University, in honour of the late Prof. H. Alleyne Nicholson. Prof. J. Arthur Thomson and Mr. J. E. Marr, F.R.S., have undertaken the preliminary steps and are prepared to receive subscriptions from "those who were friends, colleagues, collaborateurs or old students" of Prof. Nicholson.

MR. T. J. I'A BROMWICH, Fellow of St. John's College, Cambridge, has just been appointed professor of mathematics in Queen's College, Galway, in succession to Prof. A. C. Dixon, lately appointed professor of mathematics in Queen's College, Belfast. Mr. Bromwich graduated as senior wrangler in 1895, and subsequently obtained a first class (first division) in the second part of the mathematical tripos. Since taking his degree he has made a number of original contributions to various branches of mathematics.

ANNOUNCEMENT is made in the *Times* that Lord Curzon, the Viceroy of India, has appointed a commission to visit the University centres and colleges of India to inquire into their prospects, report on their working, and recommend measures for the improvement of the teaching and the standard of learning. The commission is composed as follows:—Mr. T. Raleigh, president; Syad Hossain Bilgrami Nawab; Mr. J. P. Hewett, Secretary to the Home Department; Mr. A. Pedler, Director of Public Instruction in Bengal; Prof. A. Bourne, Principal of Madras College; and the Rev. Mr. Mackichan, Principal of Wilson College, Bombay. Mr. R. Nathan will act as secretary.

PROTESTS are being made against the dissolution of Victoria University. It is suggested that there might be one great University for the north and not several connected with single cities. At a meeting of graduates of Victoria University held at Leeds on January 24, a resolution was unanimously adopted expressing the conviction that to abolish the Victoria University would be detrimental to the interests of higher education in the north of England. A committee was appointed to attend an approaching meeting at Manchester in connection with the Victoria University and protest against its disruption. The board of governors of the Yorkshire College, Leeds, has adopted a resolution expressing the view that though the dissolution of the Victoria University in favour of separate universities would be detrimental to the interests of education in the north of England, still, having regard to the resolutions passed by Owens College, Manchester, and University College, Liverpool, preparations should be made for the establishment of a University for Yorkshire based upon the existing Yorkshire College, with provision for the admission of other constituent colleges and for the affiliation of other suitable institutions.

THE annual meeting of the Association of Directors and Organising Secretaries for Technical Education was held on Friday last. Mr. A. Keen, the president, delivered an address dealing with the question of rural education. He urged that what are wanted are:—(1) A system of suitable elementary instruction which should include practical work in every standard; (2) a good supply of secondary schools at low fees of the rural grammar school or modern school type, taking, say, the Rural School of Science course in the Government Directory, and such other studies as the circumstances of different districts might direct; (3) a more limited supply of higher secondary schools of the high-grade grammar school type for boys and girls who were intended to continue their education beyond the usual age, and probably go to a university or some other place of advanced education; and (4) for the benefit of boys intended to be farm bailiffs, agents, stewards, farmers, or market gardeners, and especially those who had no suitable means of acquiring at home an intimate knowledge of farm and garden work and general practical experience, there should be in every large county, and in every group of smaller ones, a farm school, or an agricultural school or college, for boys of fifteen to sixteen years of age and upwards, providing a course of instruction for two or three years of a thoroughly practical character.

AN interesting introductory address delivered by Prof. Wilson, professor in anatomy at Sydney University, has been sent to us. The address is entitled "Ideals in Medical Education"; it is

well worthy of careful perusal, and in a short paragraph only the very salient points can be touched upon. The author begins with a plea for centralisation and a note of warning against the multiplication of universities, when ample means are not to hand for their equipment. Local convenience is undoubtedly an important consideration, as is also emulation between districts for the possession of intellectual centres, but both of these should be subordinate to the true interests of education. The equipment of the modern university is necessarily a very costly matter. The next point we can consider is the length of the medical curriculum. Prof. Wilson directs attention to the value of general education to the medical student, and views with regret the abolition by many universities of the obligatory preliminary degree in "Arts." In this connection he refers to the new regulations at Harvard, in which it has been enacted that the medical student shall undergo a preliminary four years' course in arts before entering upon his four years' medical curriculum. In view of the present controversy concerning elementary medical education, it is of interest to note that the author appears to accept the general educational value of special medical studies, but is apparently not in favour of the relegation of physics, chemistry and biology to the schools. The chief reason against this is the assumption that it would still add another year to the curriculum, and "this might be as well done frankly under university guidance." It may be objected, however, that the boy could perfectly well begin these studies at sixteen, and it is certainly a very open question whether at such an age he is better at the school or university. With regard to pharmacology, Prof. Wilson would relegate the experimental part entirely to the physiologist and the therapeutical part entirely to the physician. He apparently does not see in pharmacology as at present taught what he describes so accurately in the case of general pathology, namely, a "bridge-like" position in the medical curriculum, fitting the student, when essentially pursuing the intermediary subjects, for the problems awaiting him in the wards, and enabling him to utilise to the full the relatively small clinical experience which he will obtain. In conclusion, Prof. Wilson admits that the medical curriculum is at present full to overflowing, and recommends a somewhat novel plan to relieve it. He suggests, and instances certain American universities as precedents, a more universal use of the honours system. He would establish a system of "elective studies," would allow the student to specialise earlier in his career, and while demanding certain evidence of all-round knowledge, would very considerably reduce the standard in it, according to the depth and thoroughness of the work done by the student in certain directions. It must be admitted, however, that the magnitude of the irreducible minimum would be difficult to decide, as would also the thoroughness of "work done by the student in certain directions."

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 23, 1901.—"On the Intimate Structure of Crystals. Part v.—Cubic Crystals with Octahedral Cleavage." By Prof. W. J. Sollas, F.R.S.

November 21, 1901.—"On Skin Currents, Part ii. Observations on Cats." By Augustus D. Waller, M.D., F.R.S.

In part i. it was stated that the normal electrical response of frog's skin to excitation is outgoing, from internal to external surface. In the skin of the pad of the cat's foot the electrical effect of excitation of the sciatic nerve proved to be ingoing, as stated by Luchsinger and Hermann. Dr. Waller determined this fact by decapitating cats and immediately testing the effect of excitation of the sciatic nerve on the pad of the foot; the effect gradually declines and disappears an hour after decapitation. It is pointed out that this experiment on a freshly killed animal is a convenient class demonstration of a fundamental fact which it has hitherto been thought necessary to demonstrate on living animals. The effect is elicited after the sciatic has ceased to provoke muscular contraction; the largest response observed and photographed was ·0100 volt, the lost time was three seconds.

In order to observe the response to direct excitation, the pad of a cat's foot was cut off and set up between unpolarisable electrodes; during the first forty-eight hours there is a normal ingoing current of ·0100 volt. If after exact compensation of this current a single induction current is sent in in either direction, the after-effect is nearly always outgoing, as in frog's skin; an ingoing effect is observed with a fresh skin and weak excitation.

Dr. Waller thinks it probable that both ingoing and outgoing forces may co-exist in the excited skin, the galvanometer expressing the resultant. In order to investigate the causes of the variability of the direction of response, the A B C method is devised:—Three electrodes are applied to the external surface of the skin, the third electrode C being used to examine separately the effects at A and B. By means of an especially designed switch called the M-shaped switch, an excitation can be applied at A and B, and the response led off through C and A, or C and B. The response is found to be always an outgoing current at A or B for both directions of excitation.

Physical Society, January 24.—Prof. S. P. Thompson, president, in the chair.—A paper on the factors of heat was read by Mr. James Swinburne. In all branches of physics, except heat, energy is divided into pairs of factors. Heat is generally thought of as a sort of indivisible energy and is not split into factors, but is treated as a whole, so that we have conductivity for heat, capacity for heat, specific heat, &c. Capacity for heat and specific heat are also taken when they include external work, at constant pressure for instance; so that the capacity is reckoned as capacity for energy which is only partly in the body or substance. So little is heat realised as energy that it has its own unit, so that equations involving other forms of energy with it need to be complicated with a coefficient. Temperature might be a factor of heat, but there is no corresponding quantity factor. There is no unit of temperature, it is measured in degrees which have no proper connection with anything. Temperature is sometimes treated as a tension factor with heat as the quantity factor, as when heat is said to run down temperature. Heat is thus regarded as its own quantity factor. Entropy is sometimes incorrectly used as the quantity factor corresponding to temperature. Entropy is at present indispensable as a function involving information as to whether heat has been or might have been converted into work. The author discusses "chy" as a possible factor for use with absolute temperature where "chy" is a quantity factor such that when multiplied by the temperature at which it is added or withdrawn gives the energy added or withdrawn. In the θ, χ system capacity, specific capacity and conductivity vary inversely as the temperature. These factors are not analogous with the factors of other forms of energy and are not convenient. The energy of heat is therefore split into $\tau\,\pi$, where τ is proportional to the square root of the temperature and is called by the author "tasis." The other factor, π, is called "posot." In any gas, tasis is proportional to the effective velocity and posot to the momentum. Tasis and posot are analogous to the tension and quantity factors already in successful use and indispensable in the treatment of other forms of energy. Conductivity of posot follows Ohm's law and the capacity of a body for posot is constant.

Chemical Society, January 16.—Prof. J. Emerson Reynolds, V.P.R.S., president, in the chair.—An investigation of the radio-active emanation produced by thorium compounds, by Prof. Rutherford and Mr. Soddy. The authors have previously shown that whilst thoria gives rise to a Becquerel radiation, it also communicates to gases passed over it a radio-active substance referred to subsequently as the emanation. They find that the emanating power of the oxide is destroyed by heating and can be restored by reprecipitation, and, further, that probably the emanating power is not a specific property of thoria, but is due to the presence of some foreign substance. As regards the nature of the emanation itself, it appears to be a gas of the argon type, since it is not destroyed by such powerful agents as red-hot lead chromate, white-hot platinum black, red-hot magnesium, &c.—The constitution of hydrocyanic, cyanic and cyanuric acids, by Dr. F. D. Chattaway and Mr. Wadmore. It is generally assumed by chemists at the present time that in these substances the hydrogen is joined to carbon and that they must be represented by such formulæ as H.C:N, HO.C:N, &c. The view that they are really the *iso*-compounds of the formulæ C:N.H, O:C:N.H, &c., is again brought forward by the authors, and the evidence afforded by the behaviour of the haloid cyanogen compounds—which is that of substances containing the haloid joined to nitrogen—is shown to necessitate their representation by such *imino*-formulæ.—A modification of Zeisel's method for the estimation of methoxyl groups, by Dr. J. T. Hewitt and Mr. T. S. Moore. The