

not think it necessary that strict mathematical proofs should be given for everything. An engineer learned physical constants, and physical data might be taken for granted. He believed that the education of the engineer in mathematics would gain and not lose if instead of strict proof there was more of illustration. Prof. Barr gave the calculus an important position, but expressed his desire for the portable formulæ advocated by Prof. Perry. Dr. H. S. Carslaw, in the course of some remarks, said if teachers in schools would anticipate the teachers in the colleges by using graphical methods they would not hear mathematics spoken of as killing thought and destroying education. At present Euclid is given far too prominent a position in school work, with the result that algebra and trigonometry suffer. Prof. G. A. Gibson expressed general agreement with the views of Prof. Barr. He would not, however, insist too much on doing away with logical demonstration. The foundation for the teaching of mathematics should be laid at school, and he complained that two years of a school-boy's life were worse than wasted by the enormous amount of rules which he had to commit to memory, which were of no intellectual interest and which he was almost certain to forget.

THE Education Committee of the General Medical Council presented a second report on the steps to be taken for the improvement of preliminary examinations at the meeting of the Council last week. Sir John Batty Tuke, chairman of the Committee, in presenting the report explained that in November, 1898, the Education Committee was asked to report when, in its opinion, it would be practicable to raise preliminary examination to the senior and higher standards. In June, 1899, the Committee reported, after consultation with a large number of educational authorities, that it would be better if educational experts were appointed to review the circumstances of all examinations. Experts were appointed, and in December, 1899, the Committee submitted a report, along with a report of the experts, who held that it was impossible to raise the standard to the senior or higher grade in the present condition of secondary education in Great Britain. Thereupon the experts were asked to state reasons for the belief. In March, 1900, they gave these reasons, and the Committee was then enabled to work upon certain fixed principles. The principal difficulty met with was how to produce a rise in the character of examinations in reality, a real *bona-fide* rise. It was easy to make an examination look more serious on paper than it really was. The Committee had not asked for this to be done, but had made representations to the various examining bodies, asking them to raise the standard of the pass-marks rather than increase the difficulty of an examination. Feeling that the Council had the true interests of education at heart, the various examining bodies had met the Committee in the most conciliatory spirit and had, wherever necessary, provided examinations in order to bring about a common good. The Committee expressed the opinion that it would not be practicable to raise the standard of the examinations until the state of secondary education in the country was in a less chaotic condition than it is now. The responsibility lay with the country, and it was sincerely to be hoped that the Government during the next session would bring forward a strong measure by which this important object might be attained. After some discussion, the Council adopted the motion "That the report of the Education Committee on the steps taken for the improvement of preliminary examinations be approved."

SCIENTIFIC SERIAL.

Bulletin of the American Mathematical Society, November.—On wronskians of functions of a real variable, by Prof. Bôcher, has for its object the settling certain questions connected with the subject so as to clear the way for further investigations—such as whether the roots of wronskians of sets of linearly independent solutions can have an infinite number of roots in a given interval, and also the question to what extent the theory of the adjoint (adjungirte) differential equation remains valid when the coefficients of the differential equation are not assumed to be analytic but merely continuous functions. To do this he considers the slightly more general subject of linear families of which the solutions of a homogeneous linear differential equation form a special case. The paper was communicated at the August meeting of the Society, as also was the following, on the configurations of the 27 lines on a cubic surface and the 28

bitangents to a quartic curve, by Prof. L. E. Dickson. After determining four systems of simple groups in an arbitrary domain of rationality which include the four systems of simple continuous groups of Lie, the author was led to consider the analogous problem for the five isolated simple continuous groups of 14, 52, 78, 133 and 248 parameters. The groups of 78 and 133 parameters are related to certain interesting forms of the third and fourth degrees respectively (Cartan's thèses), and these suggest certain forms discussed in the paper.—Dr. G. A. Miller gives an account of the mathematical work done at the fiftieth annual general meeting of the American Association for the Advancement of Science. There are given the titles, with abstracts, of twenty-five papers.—Prof. J. S. Ames reviews "Die partiellen Differentialgleichungen der mathematischen Physik" (nach Riemann's Vorlesungen in vierter Auflage neu bearbeitet von Heinrich Weber, erster bd. 1900, zweiter bd. 1901).—Amongst the notes are included the Cambridge mathematical courses for the current academic year.—New publications as usual.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 21.—"On the Properties of the Arterial and Venous Walls." By John A. MacWilliam, M.D., Regius Professor of Physiology in the University of Aberdeen. Communicated by Sir Michael Foster, K.C.B., Sec. R.S.

November 28.—"A Comparative Study of the Spectra, Densities and Melting Points of some Groups of Elements, and of the Relation of Properties to Atomic Mass." By Hugh Ramage, B.A., A.R.C.Sc.I., St. John's College, Cambridge. Communicated by Prof. Liveing, F.R.S.

It has been usual for investigators to rest satisfied when the properties of the elements were shown to be "a periodic function of the atomic mass." Diagrams drawn by the method employed in this paper will show in what degree the properties vary with the atomic mass, and will make it easier to establish the exact quantitative relations.

The work and results presented by the author make it clearer that the properties of the elements are fundamentally due to the structure, as revealed by their spectra, of the atoms rather than to the quantity of matter in them. It is inconceivable, for instance, that the change from calcium to strontium proceeded through the intermediate elements when we consider that the strontium molecules must have a similar structure to those of calcium. This structure is so simple that the fundamental (Bunsen flame) spectrum of each of these elements contains only one line attributed to the element. The anomaly, according to Mendeleëff's law, in the atomic masses of tellurium and iodine is further evidence of this. The properties of these elements may have nothing whatever to do with each other. They are, however, closely related to and in correct order with those of the elements of their respective groups. The genesis was not in the direction of tellurium to iodine, but from, or perhaps through, oxygen and fluorine respectively. So also is this the case with the other groups.

It is more probable that in the genesis of the elements the properties of certain fundamental matter are modified by successive additions of matter to them, or by causes of which this is to us the apparent result. The regularity in the changes in the properties of lithium, beryllium, boron and carbon, as seen in the diagrams, is very remarkable. It is, furthermore, very suggestive, for the changes in properties are approximately proportional to the quantity of matter in the atom in excess of a constant quantity (which is about 6), as if it were the same matter that is added in each case.

Geological Society, November 20.—Mr. J. J. H. Teall, V.P.R.S., president, in the chair.—Dr. Vaughan Cornish exhibited photographs of waves and ripples in water, cloud, sand and snow.—Notes on the Genus *Lichas*, by Mr. F. R. C. Reed. The *Lichadidæ* are divided into two great groups: (1) that with a pair of bi-composite lateral lobes to the glabella and a more or less definite fourth pair of lateral lobes; and (2) a group with a pair of tri-composite lateral lobes, through the fusion of the fourth pair with the bi-composite pair of the preceding group. Names are proposed for each group, and also, where necessary, for the eight sections, of subgeneric value, into which each group is subdivided. The