

of the college to give an equal sum, conditionally upon the college being incorporated in the University of London, and concurs in the resolution of the council to enter into negotiation with the University with a view to the incorporation." He said the idea of incorporation was not a new one, because when the statutory commissioners were sitting for the purpose of framing the statutes for the reconstitution of the University of London, the council represented to them the intention of the founders and benefactors of University College would only be carried out by incorporation. The commissioners, however, felt that the terms of the Act did not make it possible for them to give effect to the proposal. The council had not abandoned the policy, and since the beginning of the present year events had taken place that brought it within the range of speedy realisation. With regard to the appeal for funds, it was quite obvious that if the work which was being carried out was to be continued, the funds would need a much larger increase. Lord Monkswell, who seconded the resolution, hoped there would be many rich men who would follow the example of their anonymous benefactor. He trusted that the negotiations which they were having with the University of London would be successful, and said that no conciliatory efforts on their part would be wanting. The resolution was adopted.

THE address delivered before the Association of Technical Institutions on January 31, by the president, Lord Avebury, is published in the official report of the proceedings of the meeting. The address was, in a large part, a plea for more liberal recognition of science and modern languages in the time-tables of our schools, supported by the opinions of commissions and other competent authorities. Classics has at present too large a portion of the available time, and science is only tolerated. "An education which excludes science is a one-sided education, and the most learned classical scholar, if he knows nothing of science, is but a half-educated person after all." But the question is not so much one of culture as of equipment for national progress. When, as Lord Avebury remarks, we find commission after commission (composed of men selected for their wisdom and experience), after careful and patient inquiry, one after the other, and with remarkable unanimity, pointing to the neglect of science and of modern languages in our educational system as a grave evil, it must surely be worth while to inquire whether these warnings have been taken to heart, or the recommendations have been carried into effect. Lord Avebury gives instances, most of which are known to readers of NATURE, of industrial progress in Germany due to technical training. "It is evident then," he concludes, "that the technical instruction of Germany has been a very remunerative investment; in the first instance, no doubt, a great national advantage, but a boon also to the world as a whole. These figures bring home to us clearly the importance of the subject. It is obvious how keen competition is going to be. If we are to hold our own, we must supplement the rule of thumb in our workshops—very important in itself—by the rule of brain. Emerson once said that this country 'is prosperous because steam is half an Englishman.' We all hope that Britannia may long rule the waves, but it is most important that she should rule the steam engine and the dynamo as well."

SCIENTIFIC SERIAL.

American Journal of Mathematics, vol. xxiv. No. 1, January. —Cyclic subgroups of the simple ternary linear fractional group in a Galois field, by L. E. Dickson. This paper is an addition to the author's previous one in vol. xxiii. pp. 231-252. It gives proofs of results therein stated and adds some new theorems allied to them. The question discussed concerns the substitutions

$$x^1 = \alpha^r x, y^1 = \alpha^s y, z^1 = \alpha^{-r-s} z,$$

where α is a primitive root of the Galois field of order p^n . Two cases arise according to the value of the greatest common divisor d of 3 and $p^n - 1$. —Curves of triple curvature, by J. G. Hardy. The object of the paper is to add to the results which have been obtained concerning curves L of triple curvature. Equations of motion for systems in a four-dimensional space have been deduced and used to introduce the notion of an instantaneous plane of rotation. The derivation is not new, but it is retained for the sake of clearness. By constructing the principal tetrahedroid at a point of a curve of triple curvature and studying its motion by means of the kinematical equations obtained, geometrical

interpretations of the six rotations and also a set of formulæ corresponding to the Serret-Frenet formulæ for curves of double curvature have been arrived at. These formulæ have been applied to the study of curves L and, in particular, of the osculating hypersphere and the locus of its centres. Many of the results were contained in a paper read before the mathematical seminary of the Johns Hopkins University in 1898, and so were antecedent to the articles by Prof. Lovett and Mr. Hatzidakis in vol. xxii. The subject may be studied in Brunel, *Math. Ann.* xix. p. 48; Pironcini, *Giom. di Mat.* xxviii. p. 237; and Piccioli, *Giom. di Mat.* xxxvi. p. 273. —Primary prime functions in several variables, and a generalisation of an important theorem of Dedekind, by H. Hancock. Reference is made to Kronecker, "Grundzüge," &c., § 4, p. 11; Runge, *Crelle*, Bd. xcix. p. 89; Mandl, *Crelle*, cxiii. p. 252; Meyer, *Math. Ann.* Bd. xxx. p. 30, and to other memoirs. —On certain properties of the plane cubic curve in relation to the circular points at infinity, by R. A. Roberts. In this second part, which is on certain plane cubic curves and their angles of intersection, with some account of conics cutting orthogonally, the author investigates some methods of generating certain plane cubic curves in such a way that their angles of intersection assume a simple form. —Estimate of Peirce's linear associative algebra, by H. E. Hawkes. In the fourth volume of the *Journal* there appeared a memoir by Peirce in which he attempted to classify and enumerate hyper-complex number-systems. This does not seem to have received on the Continent the credit it deserves. In order that it should receive due recognition, Mr. Hawkes claims that three questions must be discussed, viz., what problem did Peirce attack, and to what extent did he solve it? what relation does this problem bear to that treated by Study and Scheffers? and to what extent do Peirce's methods assist in the solution of that problem? In the present article, Mr. Hawkes discusses the first two questions, and discusses the last in the *Transactions of the American Mathematical Society*, vol. iii. A historical review accompanies the article. It may be remembered that Mr. Spottiswoode drew attention to Peirce's work in his presidential address before the London Mathematical Society (vol. iv. p. 152); see also Cayley, "Collected Works," xi. p. 465; xii. p. 465. —Dr. G. A. Miller furnishes a short note on groups defined by the orders of two generators and the order of their product. —A fine portrait of Prof. Benjamin Peirce is given with the number.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, December 12, 1901. —"The Effective Temperature of the Sun." By W. E. Wilson, D.Sc., F.R.S.

In a memoir by the author and Mr. P. L. Gray, entitled "Experimental Investigations on the Effective Temperature of the Sun," published in the *Phil. Trans. Roy. Soc. A.* vol. clxxxv. (1894), the method described was as follows:—A beam of sunlight reflected from a Stoney single-mirror heliostat was directed into one aperture of a Boys' differential radiometer. The other aperture received the radiation from a small circular area of a strip of platinum raised to any desired temperature by an electric current, this temperature being measured by the linear expansion of the platinum as in Joly's maldometer. Knowing then the ratio of angular diameter of radiating area of platinum to that of sun, the temperature of the platinum strip, the emissivity of bright platinum, and the amount of the sun's radiation lost by absorption in the earth's atmosphere and by reflection from the heliostat mirror, it is possible in any assumption of a law connecting radiation with temperature to determine the effective solar temperature. The mean of a series of very accordant observations gave 6200° C. (absolute).

To protect the incandescent strip from draughts of air it was covered with a water-jacket of gilded brass. Possibly some of the radiation from distant parts of the strip may have been reflected between the polished walls and the strip itself and, ultimately escaping through the circular aperture fronting the radiometer, reached it and so vitiated the result. Smoking the interior of the water-jacket sensibly reduced the amount of radiation and so proved this surmise correct.

It is also possible that changes in the surface condition of the platinum may effect its emissivity, which in the original memoir was taken at 0.35 that of lamp-black (Rosetti's estimate), so that it is a distinct advantage to abolish the platinum strip as a source of radiation and to substitute a uniformly heated enclosure which would radiate as an absolutely black body.