the whole of the great marsh to the south is flooded up to Chitambo. The level at that time was made out to be 3750 feet, about 250 feet lower than Livingstone's estimate. After a rest for recovering health the expedition followed the Luapula eastward through fertile country, and leaving it where the curve from the north occurs, struck across for the Kafue, but small-pox reappeared, the land was ravaged by half-caste Portuguese slave-raiders, Mr. Thomson himself fell ill, and the course had to be changed to the south with the hope of turning west again. But matters got worse instead of better, and after touching the borders of Manica, a return had to be made to Lake Nyassa, along the southern margin of the plateau, through deep valleys, and climbing the steep slopes of the Muchinga Mountains, here separated by the great parallel valley of the Lukosashe from the plateau. All the way the land was seen to be of immense possibilities for cultivation, but neglected, and inhabited by a wretched people governed by Mpeseni, himself the vilest of them all. Kotakota on the lake was reached again on January 4th, 1891, after a total journey of 1200 miles, which resulted in many important rectifications of position and much information as to the future possibilities of the plateaux.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Dr. Hobson, late deputy Lowndean Professor, has been elected a representative of the Mathematical Board on the General Board of Studies.

Plans for a handsome building to serve as the Sedgwick Memorial Museum of Geology have been submitted to the Senate, the estimated cost being £26,000. Four members of the Syndicate appointed to prepare the plans dissent from the report of the majority, chiefly on the ground that the internal arrangements are unsatisfactory, and that the cost, initial and annual, of the proposed building will be excessive. The divergent views held on the subject will be discussed by the Senate on Saturday, December 3.

The Senate have agreed to confer on Sir R. S. Ball, the new Lowndean Professor, the complete degree of M.A., *honoris causa*.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, November 11.—Mr. Walter Baily, M.A., Vice-President, in the chair.—The discussion on Mr. Williams's paper, the dimensions of physical quantities, was resumed by Dr. Burton. He remarked that the idea that so-called "specific quantities," such as specific gravity, are pure numbers was an erroneous one, and liable to lead to difficulties. The specific gravity of a substance was of the nature of density, and was only a simple number on the convention that the density of water was taken as unity. If dimensions be given to specific quantities their interpretation would, he thought, be easy when the rational dimensional formulæ were found. Referring to Prof. Fitzgerald's comments, he said, although the contention that all energy is ultimately kinetic could not be gainsaid, the distinction commonly drawn between kinetic and potential energy involved nothing contrary to this view, and was useful and convenient in many cases. As to the dimensions of μ and k he was inclined to favour Mr. Williams's views, for several considerations suggest that the two capacities of the medium are essentially different. Arguments to show that μ was probably absolutely constant in the ether, whilst k might be variable, were brought forward. Of the two systems of dimensions for μ and k suggested by Mr. Williams, that which made μ a density seemed preferable.—Prof. A. Lodge said he was greatly interested in propagating the idea that physical quantities are concrete, and therefore welcomed Mr. Williams's paper. He thought it desirable to keep some names for abstract numbers, and "specific gravity" should be one. If another name involving dimensions was required "specific weight," or "weight per unit volume," might be used. Speaking of the dimensions of the various terms of an equation he did not think it was usually recognized that in ordinary algebra or Cartesian geometry the principle of directed terms was rigidly adhered to, for if directed at all every term of such an equation was directed along the same line. In this respect ordinary algebra was more rigid than vector algebra. Even if circular functions were involved, as in polar co-ordinates, they had the effect of making the directions of the terms the same. Other instances of problems bringing out the same fact were mentioned. Mr. Boys thought Mr. Madden had been arguing in a circle when he spoke of the astronomical unit of mass, and deduced the dimensions of mass as L^3/T^2 from the equation $MLT^{-2} = M^2/L^2$, for it was quite impossible that this equation could be true unless γ, the gravitation constant, was introduced on the right-hand side. Mr. Williams's method was quite the reverse, for he maintained that unless k and μ were introduced in the dimensions of electric and magnetic quantities, their dimensional formulæ could not indicate the true nature of those quantities, and hence were open to objection. Mr. W. Baily, whilst agreeing with Mr. Williams on most essential points, thought the total omission of L from dimensional formulæ made the expressions more complicated and less symmetrical. For example, such expressions as XY/Z, X^2 and XYZ, which respectively represent undirected length, area, and volume, might with advantage be written L, L^2, and L^3 respectively. The restriction of the dimensions of μ and k to those which give interpretable dimensional formulæ for electrical and magnetic quantities seemed scarcely justified. Both the systems proposed could not be right, and he thought it would be more in accordance with our present want of knowledge, if a quantity U of unknown dimensions were introduced such that μ or $k = U^2$. density and k^{-1} or $\mu^{-1} = U^2$. rigidity. This would keep in view the fact that the absolute dimensions of quantities involving U were unknown. A list of the dimensions of the various quantities based on this arrangement was given. Mr. Swinburne, referring to the conventional nature of many units, said great differences exist between the ideas held by different persons about such units. Starting with the convention that unlike quantities could be multiplied together, he might have six ampères flowing in an electric circuit under a pressure of ten volts, and he might say he had sixty volt-ampères. The term "volt-ampère" could be regarded as indicating that the sixty was the numerical result of multiplying a number of volts by a number of ampères, or on the other hand it might be understood as a new unit, a *watt*, compounded of a volt and an ampère. Before Prof. Rücker's paper on suppressed dimensions was published, an electrician might have suggested measuring the length of a bench by sending an alternating current through it and determining its self-induction, which he regarded as a length. Prof. Rücker, however, would say that this could not give the right result, for μ must be taken into account. He was inclined to think that dimensions were liable to mislead. Referring to scientific writers as authorities, he said Maxwell had been careless in some cases, for he had sometimes given dimensional formulæ as zero, which really ought to have been $L^\circ M^\circ T^\circ$, or unity. In French text-books the errors had been corrected. Mr. Williams, in reply to Mr. Madden's remarks about self-induction being a length, pointed out that the subject might be looked at in two different ways, depending on whether one thinks of the *standard* of self-induction as the practical standard of measurement, or the *unit* of self-induction as a physical quantity. In the former case the *standard* was a length, but in the latter the *unit* was a quantity of the same *species* as self-induction, the nature of which was as yet unknown. If its dynamical nature was known, then the absolute dimensions of all other magnetic and electric quantities would also be determined. In answer to Prof. Fitzgerald's remarks he said it was hardly likely that he should be unacquainted with the common view that kinetic and potential energies were ultimately quantities of the same kind, for it was a view with which he was quite familiar. The fact that they have the same dimensions was sufficient to show their identity, and the idea that all energy is ultimately kinetic was fundamental to his paper. This, however, did not imply that electrification and magnetization are of necessity the same, and the suggestion that they may be the same was only one of several "probable suggestions," all of which were entitled to consideration. His chief reason for regarding Prof. Fitzgerald's suggestion as probably incorrect was that it led to a system of dimensional formulæ incapable of rational mechanical interpretation, and containing fractional powers of the fundamental units. Prof. Fitzgerald's system would make resistance an abstract number, and μ and k directed quantities, whereas the former was a concrete quantity and the two latter must be scalar in isotropic media. If he (Mr. Williams) had erred in treating electrification and magnetization as different phenomena he could only plead that he had

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