was easily got by cutting slits in two pieces of tinfoil with a razor and placing one over the other with the slits at right-angles, while for a triangular aperture three strips of tinfoil placed so as to leave just a tiny triangle open gave good results.

G. H. BRYAN.

The Secular Bending of Marble.

THE fluidity of marble under pressure, of which Dr. See mentions an instance in NATURE (p. 56), has, I believe, been well established by laboratory experiments. Another instance of secular bending, similar to that quoted by Dr. See, was to be seen in two alabaster slabs which formed the jambs of a doorway in the Alhambra. Owing to the pressure brought to bear on these by the settlement of the building, they had bulged out from the wall by as much (if I remember right) as 6 or 7 inches. The slabs were about 7 feet long and a foot wide, their thickness being, perhaps, a couple of inches. Whether they are to be seen there still, or not, I do not know.

SPENCER PICKERING.

Summer and Winter.

CONCERNING the relation of summer and the following winter referred to on p. 63, a few facts from Greenwich records of the last sixty-one years may be acceptable. We find this:—

Summer warm,	winter severe,	9	cases.
,, ,,	,, mild,	19	,,
,, cold	,, severe,	17	,,
,, ,,	,, mild,	12	,,

(This leaves four cases with average values.)

It thus appears that warm summers have been distinctly more often followed by mild winters than by severe ones; but the difference in the other case, of cold summers, is less pronounced. In this representation, wet is left out of account, the mean temperatures of summer and winter being alone considered, and in relation to the averages. But we might limit our attention to summers that have been both cold and wet, as this last summer has been. (Cold summers have not always an excess of rain.) Of such there appears to have been nineteen. Now taking all those with a mean temperature under 60°·5 (the average mean temperature of summer below 61°·2), I find that nine were followed by severe winters and only three by mild winters; total, twelve. As the past summer comes in this group, the chances seem in favour of a severe winter.

A. B. M.

Personal.

I DID not think it worth while to correct an error into which the reporters of the ephemeral Press fell in prefixing the words "his own" to the word "work" in the account of my recent speech at Liverpool, where I had said that my new sphere afforded me a larger opportunity for work: simply.

I do not know how best to correct it, or whether it is now possible, but I see it has been reproduced in your University Intelligence on p. 70, and an error incorporated in NATURE is of rather permanent character, and may be misleading to my friends.

OLIVER LODGE.

Birmingham, November 21.

MATHEMATICS IN THE CAMBRIDGE LOCALS.

ON May 29 (vol. lxvi. p. 117), we announced an important change in the geometry of the *Oxford* local examinations for 1903. Quoting from the notice which had just been issued, attention was directed to the important statement that "Questions will be set so as to bring out as far as possible a knowledge of the principles of geometry, a smaller proportion than heretofore consisting of propositions as enunciated in Euclid. Any solution which shows an accurate method of geometrical reasoning will be accepted. No question will be set involving necessarily the use of angles greater than two right angles. Geometrical proofs of the theorems in Book ii. will not be insisted upon." We have now received the schedules in geometry that have been adopted for the *Cambridge* preliminary and junior local examinations in 1903. In these, we are glad to see that the Cambridge Syndicate has adopted to an even greater extent the reforms suggested by the recent British Association Committee. For the preliminary, junior and senior examinations:—"Any proof of a proposition will be accepted which appears to the examiners to form part of a logical order of treatment of the subject. In the proof of theorems and deductions from them, the use of hypothetical constructions is permitted." No schedule will be published for the senior examination. The importance of the schedules now published for the preliminary and junior examinations will be apparent when it is considered that they may be said to cover the work done by the boys and girls in all secondary schools up to the age of sixteen years, and the work of such older boys and girls as are not trying for marks of distinction. Their influence is great, and we heartily welcome the important change that they place much greater stress upon observation, measurement and experiment than on abstract reasoning. It is to be observed also that there is no mere pretence of accuracy:—"Every candidate must be provided with a ruler graduated in inches and tenths of an inch, and in centimetres and millimetres, a small set square, a protractor, compasses furnished with a hard pencil point, and a hard pencil." This mention of the hard pencil is business-like; as soon as boys understand that in their measurements of lines they must not make errors of even one-hundredth of an inch, their true scientific education begins. As for demonstrative geometry, a great number of Euclid's propositions are left out altogether. Books ii. and iv. have completely disappeared. Twenty-eight out of the forty-nine propositions of Book i. have to be studied for the preliminary and junior. Of the thirty-seven propositions of Book iii., only ten have to be studied for the preliminary and four more for the junior. Of the thirty-five propositions of Book vi., only thirteen are required for the junior. The most important part of the geometry examination is called practical geometry, and there is every inducement to all teachers now to dwell largely on experimental geometry, as all good teachers have done for many years.

We have reason to believe that in dealing with arithmetic, algebra and trigonometry, the syndicate will follow, as closely as it has done in geometry, the recommendations of the British Association Committee as drawn up by Prof. Forsyth. Should this be so, we are assured of a very great reform in the teaching of mathematics in all the secondary schools of England. This consummation will be further assured by recognition of the reform, which will surely come soon, on the part of the Civil Service Commissioners and all other examining bodies in the kingdom. We may say, then, that every average boy looking forward to a career in the Civil Service, in the Navy, in the Army, in any of the professions, will have had an incubus lifted from his life, and a much greater load will have been lifted from the spirits of his father and mother. Boys susceptible of being crammed for examinations will no longer have an unfair advantage over their far wiser and more sensible but reputedly stupid fellow competitors. There will, moreover, be a chance that boys from schools will be able to take better and fuller advantage of the instruction given in technical colleges.

To the educationist, the reform, however far-reaching in its results, may appear small; he may think that it should have been effected long ago. This view, however, does not in our opinion do justice to the services of the reformers. It leaves out of account the strength of the opposition. This reform needed that many men should work in an unhopeful, heart-breaking way for it for many years, and its importance is not diminished by its coming at last quite suddenly, and as if miraculously, like the fall of the walls of Jericho.

In criticism of the schedules, we may perhaps be allowed to say that personally we wish the syndicate had not followed Euclid so closely. All the practical geometry of the syllabus is mere illustration of Euclid. There are, for example, other angles than 90° easily to be drawn; arithmetical computation and experimental mensuration give new avenues to geometrical ideas, and the more avenues we can offer to pupils the better. Where the syllabus says "division of straight lines into a given number of equal parts," there appears to us too much restraint. There is no reason why a line should not be divided into many parts in any proportions, and a most educational exercise it would be. And what is the use of hiding the fact that a "preliminary" candidate cannot be prevented from having a good working knowledge of Book vi., although it is wise enough to keep the demonstrations to a later stage? Any boy understands that maps may be drawn to different scales, and this is almost the whole of the sixth book of Euclid. As for construction of tangents to a circle and "construction of common tangents to two circles," we would let a student draw these without introducing any idea of difficulty and we would ask him, by dropping perpendiculars on tangents from centres, to find the real points of contact. As soon as a boy can draw a right-angled triangle, measuring the sides and using arithmetic to find sines, cosines and tangents, he ought to begin trigonometry. If he knows the mere definition of *tan* A, he ought at once, by merely exercising his common sense, to be able to draw the angle the tangent of which is given. A common-sense knowledge of right-angled triangles is really a knowledge of solution of triangles in general. But until the artificial bulkheads between the various water-tight compartments of mathematics are swept away, we suppose that it will not be possible to give to very young schoolboys the power to solve trigonometrical problems. If the syndicate would condescend to study the elementary syllabuses of Science Subjects I. and V_p of the Education Department, we think these courses of studies might become much easier and much more valuable.

But is not ingratitude the meanest of sins? And may it not show wisdom in the syndicate that it avoids changes which may seem to be too sudden and too great? Besides, it is to be recollected that almost every candidate who has followed this course has also taken a course in experimental science, into which weighing and measuring, the uses of squared paper and logarithms, and the ideas of the calculus have entered in all sorts of common-sense ways. Even taken by themselves, the schedules mark a great step in our experiment of finding a method of teaching mathematics suitable for boys of the Anglo-Saxon race. A beginning has been made in disenchanting the English school system of those pedagogic dogmas which have tied teachers and pupils hand and foot. Teachers and examiners will ask for more and more freedom as they find that it is altogether good. Hitherto, the average English boy has believed himself to be stupid because he was unable to reason about things unknown to him; hitherto, the average English teacher of mathematics has thought of himself as a dull, tired usher because he has had no interest in teaching; in future, pupils and teachers will feel with complacent pride that they have come to their inheritance as thinking, useful human beings. We look forward to very great results, and we are not going to give credit in particular to any one of the ten or twenty names that rise before us of the men who have helped to make this reform. Those who are dead had their reward in knowing that they helped towards a reform that was certain to come; those who are alive have the reward of knowing that they were commissioned to keep alight the torches lit by their much-loved predecessors.

With the exception of the Society of Arts, no institution of the country has been so successful in initiating scientific reform as the British Association. A Committee was appointed in 1874 (the present writer is proud to think he was a member of it) for improving science teaching in schools, and another for improving mathematical teaching, and although the members of these Committees were mostly men of influence, their efforts led to no important results for many years. But ten years afterwards, the report of a British Association Committee on the teaching of science acted on the scholastic world like the prince's kiss in the story of the Sleeping Beauty, and in 1901 the British Association proceedings in the new Education Section acted in much the same magical way in relation to the teaching of mathematics. Many mathematical masters were feeling hopeless about reform, but without jealousy, with great enthusiasm, with the most wonderful forgetfulness of differences in small matters, they joined together to assist the British Association Committee of Mathematicians. There can be no doubt that this evidence of a desire for reform among the schoolmasters had a great effect upon the members of the Committee who were not in immediate touch with the schools. All the tact, patience and resourcefulness of a chairman eminent for these qualities might have been unavailing in dealing with a Committee the members of which were all men of great individuality had it not been for the schoolmasters' memorial. Anyone who knows the history of this reform must recognise its peculiarly English characteristics—the conservative clinging to past methods because of the recognisable good in them, even among the most radical reformers; the efforts of individuals in low and high positions gradually making converts in spite of the seeming hopelessness of reform; the unwillingness of men in high positions to lend their names to the movement, the virtue of which they were aware of, so long as they thought that only unrest and disturbance could accompany it; and their concerted action as soon as it was evident that a great reform was possible. And now, because it has occurred in the English way, we know that the reform is real, that it will have a fair chance, that it will go on year after year for many a year to come. This is no case of a thin end of a wedge, for no force is really required. It would be bad policy to make too great a change at once. Freedom has been given to teachers, a freedom much sighed for, a freedom which will create enthusiasm. Those who are most determined to make the reform complete are most anxious to proceed cautiously and to smother intemperate zeal.

JOHN PERRY.

THE THEORY OF THE GAS MANTLE.

A NUMBER of papers have been recently published which deal, either directly or indirectly, with the cause of the high efficiency of the incandescent gas mantle.[1] Space does not permit us to enter at all fully into the details of these papers, but it is of interest to consider some of the questions which they raise.

The high luminosity of the mantle and its still more remarkable dependence on a particular composition have long been recognised as facts calling for some special explanation, and many have been the hypotheses advanced to account for them. The simplest of these is that which

[1] "Zur Theorie des Auerlichtes," by W. Nernst and E. Bose (*Physikalische Zeitschrift*, 1900, i. 289).
"Theory of the Incandescent Mantle," by A. H. White, H. Russell and A. F. Traver (*Journal Gas Lighting*), lxxvii. p. 879, and lxxix. p. 892).
"Theory of the Incandescent Mantle," by A. H. White and A. F. Traver (*Journ. Soc. Chem. Industry*, 1902, xxi. p. 1012).
"The Conditions Determinative of Chemical Change and of Electrical Conduction in Gases and on the Phenomena of Luminosity," by Prof. H. E. Armstrong, F.R.S. (*The Chemical News*, May 23 and 30, 1902).
"The History of the Invention of Incandescent Gas Lighting," by Auer von Welsbach (*The Chemical News*, May 30, 1902, p. 254).