to 1450° C. (within the δ range) and similarly cooled. On examination, a striking difference in structure between the two was found, constituting evidence that there is a distinct change in crystal structure at the δ to γ transformation. This may be regarded as a confirmation of Westgren's conclusion,[1] based on X-ray analysis, that δ and γ iron are constitutionally different. He found that the former has a body-centred and the latter a face-centred cubic lattice. H. C. H. C.

[1] Journal of the Iron and Steel Institute, 1922, No. 1, p. 241, and NATURE, June 24, 1922, p. 817.

The Indian Eclipse Expedition, 1922.[1]

THE story of an expedition to observe the total eclipse of the sun, seen under the most perfect atmospheric conditions, but which failed to achieve any results, is described by Mr. Evershed in the report before us. Mr. Evershed's programme was of a high-class order, and those who know him and his great ingenuity in the construction and manipulation of astronomical apparatus will share his regret at his extreme misfortune on this occasion.

Originally Mr. Evershed proposed to occupy the Maldive Islands as his observing station, but, owing to difficulties of transportation, he and his party went to Wallal, near Broome, situated on the north-west coast of Australia, and joined Dr. Campbell's expedition. For the Einstein effect he took out with him a 12-inch photo-visual lens particularly well adapted for this problem, giving, as he states, "a large field of good definition and a larger scale than the lenses used previously, or that would be likely to be used by other expeditions." It was worked in conjunction with a 16-inch cœlostat, and it was the erratic behaviour of this instrument that spoilt the results. In spite of constructing a new tangent screw and refiguring the teeth of the driving sector to secure better driving qualities, the fifteen seconds exposure plates showed movement of the star images and poor definition of the corona due to the bad driving of the cœlostat. Two short exposure plates were badly fogged "in some unexplained way" over two-thirds of the surface, but otherwise the remaining portion showed the ends of the coronal streamers beautifully defined.

The second main effort of the expedition was to photograph with large dispersion the spectrum of the corona on the east and west limbs simultaneously, in order to determine the displacement of the green corona line due to the solar rotation, and to secure a more accurate wave-length of this line. Here again disappointment was experienced, for the corona line did not appear at all on any of the plates owing, probably, to the unusual faintness of this radiation at this eclipse. Perhaps Mr. Evershed rather courted disaster on this occasion, as it is generally conceded that during the time at and near a minimum of solar activity this radiation is also near a minimum of brightness.

[1] Report of the Indian Eclipse Expedition to Wallal, Western Australia, by J. Evershed, F.R.S. (Kodaikanal Observatory, Bulletin No. 72.)

It will be remembered that the Greenwich expedition to Christmas Island purposely eliminated the use of a cœlostat in its work by taking out a complete equatorial photographic telescope. This was done because experience at the eclipse of May 29, 1919, seemed to suggest that the definition of the star images on the astrographic plates was poor, owing probably to the distortion of the cœlostat mirror by the heat of the sun. Mr. Evershed's view regarding the employment of a cœlostat is that it is "good for the Einstein effect. For only with a cœlostat is it practically possible to get an adequate scale." That he is emphatic on the point is shown by his statement that "the question of the cœlostat mirror introducing complications is, I think, a bogy. Plane mirrors can now be constructed of large size and perfect figure, and experience with mirrors, good and bad, has shown that little is to be feared from distortion of the surface when the silvering is fresh and good, and simple precautions are taken."

In the opinion of the present writer, the great drawback to the use of a mirror during eclipses, whether mounted as a cœlostat or siderostat, is due to the change of figure of the plane surface of the mirror, which causes an alteration in the position of the focus of the object glass. On many occasions during eclipse expeditions, although extreme care had been taken to secure a "perfect" focus on star spectra at night (the mirror then being comparatively cool), the focus was quite different for the solar spectrum during the daytime. Thus during eclipse work it was always found most necessary to watch very carefully the disappearing crescent of the sun on the ground glass almost right up to the time of totality, and if necessary alter the position of focus accordingly.[2]

It is satisfactory to note that Mr. Evershed did not return to India with an empty bag. During a short stay at Broome on the return journey he set up the 16-inch siderostat and 12-inch lens and succeeded in obtaining a good high dispersion spectrum of Canopus and Achernar to use in connexion with his work on the spectrum of Sirius.

During this expedition Mr. Evershed was ably assisted by Mrs. Evershed and by Mr. Everson of the physics department of the University of Western Australia. WILLIAM J. S. LOCKYER.

[2] See Phil. Trans. Roy. Soc. A, vol. 198, p. 406.

Liberal Education in Secondary Schools.

ON Saturday, June 9, a conference of educationists in Yorkshire was held in the University of Leeds under the presidency of the vice-chancellor, Sir Michael Sadler, in response to a widespread desire to discuss certain questions affecting the supply of full-time education for boys and girls beyond the age of eleven years, and the choice of subjects in the School Examinations. In order to make the conference widely representative of educational opinion in Yorkshire, invitations were issued to the local education authorities, the universities, the training colleges, secondary schools, associations of secondary and elementary teachers, and other persons of educational experience. Upwards of 270 representatives attended the conference and were welcomed by the pro-chancellor, Mr. E. G. Arnold.

In an introductory speech, the chairman referred to the growing desire for wider opportunities of a liberal education in various parts of the world. This desire cannot be wholly explained as due to self-regarding motives. Ambition for advancement is no doubt a strong motive, but is not in itself

blameworthy, especially when cherished by parents for their children. Sir Michael Sadler believes the movement has its counterpart in the movement towards greater freedom in self-government, and its deepest sources lie in a desire for liberty and the more generous development of human personality. Enlightenment and self-discipline are the two inseparable sides of a true liberal education. The force behind the desire for such an education is so powerful that it is the part of wisdom not to disregard it. He thinks that a liberal education begins away back in elementary education and extends beyond the limits of university education; that some of its indispensable factors cannot be tested by examination; and that it may be secured through diverse curricula, provided that in every curriculum a humanising spirit prevails.

Certain resolutions were thereafter submitted to the conference. After a lengthy and interesting discussion, in which a large number of delegates took part, the following motion was adopted: "That representations be made to the Board of Education urging the pressing need of further provision (by legislative change, if necessary) for the full-time education of boys and girls up to the age of sixteen, to include instruction of varying types." To this was added an addendum in favour of the pressing need of joint action between elementary and secondary branches of the Board of Education with the view of such provision and the closer combination of elementary and higher education. It is perfectly evident that there exists a large body of opinion in Yorkshire strongly in favour of greater facilities for education beyond the age of eleven and up to the age of sixteen. It is not so clear that opinion has definitely crystallised out as to the form this education should take. County Alderman Jackson, chairman of the West Riding Education Committee, expressed the opinion that the atmosphere of the mine and factory is not suitable for children between fourteen and sixteen; at that age they should be in cultured surroundings, and without doubt he expressed the views of an overwhelming majority of those present.

On the question of greater variety in curricula a discussion arose as to the desirability or otherwise of creating a new type of school in which instruction might be given of a kind different from that now normally offered in the secondary school. It was argued with some cogency that such a school might come to be looked upon as a school inferior in grade, providing an education of an inferior type, notwithstanding the suitability of the courses of instruction provided by it for the particular purpose. There is the danger, too, of segregating one class of children. Undoubtedly the great bulk of the pupils who would attend such schools would be drawn from the elementary schools. It is quite evident that many members of the conference would view with disfavour any further differentiation of schools while accepting the principle of greater differentiation of curricula. Obviously to them the logical position is to demand a common name for all full-time education, whatever its type, between the ages of eleven and sixteen.

Sir Henry Hadow, vice-chancellor of the University of Sheffield, in an interesting speech introduced a motion which, while welcoming the greater freedom in the choice of subjects for the First School Examinations now allowed by the Joint Matriculation Board of the Northern Universities, expressed the opinion that there should be greater freedom in regard to the groupings of courses for the Higher Certificate. The motion was agreed to unanimously.

Rothamsted Experimental Station.

ANNUAL VISITATION.

AT the invitation of Lord Bledisloe, chairman of the Lawes Agricultural Trust Committee, a number of guests representing various agricultural interests visited the Rothamsted Experimental Station on Wednesday, June 13, for the annual inspection of the fields and laboratories.

The morning was occupied in a tour of some of the experimental plots, including two of the classical fields—Broadbalk, on which wheat is grown continuously, and Hoos, where barley is similarly grown. These have been for many years of the utmost value and interest to agriculturists in general, and the opportunity was taken to show the visitors some of the other plots laid down to test points that had, directly and indirectly, arisen from the results of these classical experiments. Among these may be mentioned the top-dressing series, designed to ascertain how the yield of the crop is influenced by spring dressings of artificial fertilisers applied in varying amounts and at various times; the malting barley series, in which the relation between malting value and manurial treatment is being examined; and the residual value of different manures on the succeeding crops. On this latter field the crop this year is clover, and the beneficial effect of previous organic manures, in particular cake-fed dung, is most striking.

After luncheon Lord Bledisloe briefly reviewed the purpose and recent progress of the Station. He laid stress on the care that is taken to avoid the erection of water-tight partitions between the scientific worker and the practical farmer, without in any way limiting the work of fundamental investigation, on which the application of science to agriculture is of necessity founded. Lord Bledisloe also referred to a number of the external activities of the Station, as indicative of the efforts made to keep in touch with the whole life of the countryside.

Sir E. J. Russell, director of the Station, then gave his statement on the work of the Station during the past year. The reorganisation of the laboratories has been completed, and the experimental work on the farm will shortly follow suit. Very considerable progress has been made in extending the outside centres: the experimental fields on the Woburn Farm are now in charge of Rothamsted, and Dr. Voelcker, who for many years has been in charge at Woburn, has consented to continue the work. Through the generosity of Mr. E. D. Simon, the use of an extensive farm—Leadon Court, Herefordshire—has been given to the Station, and under the management of Mr. J. C. Brown an extensive trial of the soiling system is being carried out. In addition, the Station has many centres on farms throughout the country, at each of which a repetition of a carefully designed experimental programme is being carried out. By this means it is possible in a comparatively short time to obtain trustworthy information on the degree to which the results of field trials at Rothamsted are modified at centres possessing different soil and climatic conditions. The work is being carried out at present on malting barley and potatoes with especial reference to the action of artificial fertilisers, and wherever possible the aid and support of the industrial organisations concerned have been enlisted.