three-prism spectrographs, which would separate the lines and enable better elements to be derived.

In No. 8 Mr. F. C. Jordan discusses the orbit of π Andromedæ from measures of 111 plates taken with the Mellon spectrograph between August, 1907, and October, 1909, and derives a period of 143·67 days. A point of special interest is that this binary is a helium star with a long period, and it has been shown that helium binaries are sharply divided into long and short periods. The latter are generally less than one month, whilst the shortest of the former class is 116 days. The increase of eccentricity with period is also notable, the mean periods for the two groups being 8·38 and 147·1 days, whilst the corresponding mean eccentricities are 0·19 and 0·41 respectively. π Andromedæ is a notable example, the eccentricity of its orbit being 0·58. The point is a very striking one, but the data are, as yet, too meagre to warrant speculation concerning its possible significance.

THE DISCOVERY OF KEPLER'S LAWS.—The history of Kepler's labours in working out his three laws of planetary motions is interestingly told by M. Bigourdan in No. 23 of the *Revue générale des Sciences*. Refused as a divine, Kepler pursued his study of mathematics, and was appointed professor at Gratz in 1594, then being twenty-three years of age. But in 1599 he was, as a Protestant, expelled from Styria, and accepted a post under Tycho Brahe. For a number of years he endeavoured to fit Tycho Brahe's wonderfully accurate observations into the geocentric system which the latter upheld, but without success, for there was always a residual error in latitude of 8′ or 9′, and this amount Kepler believed to be impossible in such careful observations. Then, after the master's death, he worked away at the heliocentric idea, and succeeded, eventually, in discovering the laws which are the basis of our knowledge of orbital motions. In his paper M. Bigourdan introduces many other points of interest concerning Kepler's life and methods.

BRIGHT BOLIDES.—The apparitions of several bright bolides during the latter part of 1910 are recorded in Nos. 37–38 of the *Gazette astronomique* by M. Birkenstock, director of the Bureau Central Météorique. One, recorded by several observers at different stations, appeared about 8.45 (C.E.T.) on August 19, and, as seen at Novi, was about three-quarters the size of the full moon; it then split into two parts, each half the size of the moon, and, leaving a train, disappeared after a flight which lasted three seconds. Other bolides were recorded on September 9 and 23, and October 8.

THE ASTROGRAPHIC CATALOGUE, CATANIA ZONES.—We have received part i., vol. vii., of the Catania astrographic catalogue, giving the positions of 8855 stars. These have been determined from fifteen plates covering the region oh. to 3h. in R.A., and $+52°$ to $+54°$ in declination; excluding repetitions, the net number of new positions is 7872. Tables for the geometrical corrections for zone $+53°$, with their arguments, and ten-year precession constants up to the year 2000, are also given.

CONFERENCES OF MATHEMATICAL TEACHERS AND OF PUBLIC SCHOOL SCIENCE MASTERS.

THE annual meeting of the Mathematical Association was held at the London Day Training College on January 11, and the science masters met in the same building on January 11 and 12. The officials of the college and of the respective associations made admirable arrangements, which conduced to the success of the gatherings both from the working and the social aspects.

Prof. H. H. Turner presided at the mathematical meetings, and in his address gave a historical *résumé* of the recent advance of "the astronomical regiment" under the leadership of Pickering, Stratton, Perrine, Melotte, and Cowell. He described the discoveries of the new satellites of Saturn and Jupiter, and the revelations into the past of planets which resulted from an examination of the orbits of these satellites. The members present, mostly teachers in schools, were greatly interested in the "news from the front" of the mathematical army. The annual report showed a large increase in membership and an expansion of the *Mathematical Gazette*.

Mr. G. Goodwill read a paper on the teaching of elementary mechanics, in which he recommended that dynamics should precede statics, and that the idea of change of velocity should be treated as a basal concept necessary for a proper approach to the subject. He showed an extremely simple ballistic pendulum used for measurements of change of momentum. By abandoning the usual uniplanar arrangement, he has at once simplified the exercises and tangibly increased their didactic value.

Canon J. M. Wilson described two fragments of ancient geometrical treatises found in the Worcester Cathedral Library. The first was written by Gerbert, who became Pope Sylvester II. in 979. At that time Euclid was known only to the Moors, and Gerbert failed in his attempt to enter the University of Granada. The second fragment dated from the early part of the twelfth century, and was written by a monk of Bath named Adelhard or Æthelhard. He succeeded in learning Arabic and entering the Universities of Granada, Cordova, and Seville by professing to be a Mohammedan. The fragment discovered by Canon Wilson proved to be part of a translation of Euclid from the Arabic into Latin. This translation was used in all the schools of Europe until 1583, when Euclid's own Greek text became known.

Mr. A. W. Siddons presented an important report by the Mathematical Association Committee "On the Teaching of Algebra and Trigonometry" (published by Bell and Sons, price 3*d*.). The report dealt with the function of algebra in the school curriculum for boys who were not likely to specialise in mathematics, and aimed particularly at giving teachers opportunity to develop with their pupils mathematical ideas of great educational value—ideas drawn from mechanics, mensuration, solid geometry, infinitesimal calculus, and more especially from numerical trigonometry. Mr. F. W. Dobbs (Eton) thought the recommendations went too far, whereas Mr. Barnard said that the Rugby masters thought the suggested syllabus was inadequate. Other speakers supported the views of the authors, and the general effect of the discussion was to strengthen the hands of the committee and to endorse their conclusions. The meeting referred to the committee a paper read by Mr. C. V. Durell, who urged that much commercial arithmetic should be omitted in order to find time for work more productive of mathematical intelligence.

Among interesting exhibits were a projection of the earth's surface on a cube, shown by Prof. Turner, a celestial cylinder by Dr. T. P. Nunn, and apparatus illustrating Mr. Goodwill's paper. Prof. E. W. Hobson has accepted the office of president for the coming year.

Sir E. Ray Lankester opened the science masters' meeting with an address upon "Compulsory Science *versus* Compulsory Greek." The main question he desired to raise was whether the right choice of subjects for study was made in our public schools, and whether it was right and proper, as he should suggest, to cease altogether the cumbrous efforts to teach the Greek language to schoolboys and to substitute for it as a regular and necessary part of the curriculum a well-considered, duly adapted, and skilfully designed course of instruction in natural science—using that term in the most comprehensive sense. The results of education were not transmitted by physiological heredity. Every individual born had to begin its education on a blank sheet. But man had created for himself a gigantic and overpowering possession, a sort of physical envelope of customs, taboos, traditions, laws and knowledge, which, though not transmitted to new individuals at birth as part of their structure, was yet a heritage by which man was educated. This heritage was put into his possession by gesture; by word spoken, written, or printed; by law; by the training given in the nursery and school; and by the experience of life. Individuals did not start equal, and it was the business of the educator to ascertain the various degrees of educability in the young and to adapt the course of education administered to them to their varying aptitudes. The well-educated man was he who had been enabled most fully to benefit by the accumulated inheritance of human knowledge and experience, and to enter on manhood as the heir of all the ages. The true Greek spirit was

realised, was, in fact, reborn, and existed in our present phase of civilisation in the splendid creations and the self-reliant, hopeful, and sober enthusiasm of the men of science of the nineteenth century. The Greeks, were they able to visit us now, would have nothing but contempt for our Greek compulsionists. At the conclusion of his address he proposed a possible and desirable course of school education when compulsory science had banished the usurper—compulsory Greek.

Sir William Tilden, in proposing a vote of thanks, pointed out the advances made in the schools during recent years, and mentioned that the boys who were compelled to learn Greek were fewer than those obliged to study science.

Sir J. J. Thomson was elected president for the coming year.

Mr. A. Vassall read a paper on the education of medical students, and explained the powers which the General Medical Council actually possess, and referred to further powers to which the General Medical Council appear to lay claim. He deprecated any attempt on the part of the Medical Council to dictate a syllabus of general, as distinct from technical, education. Prof. Osler, in the course of the discussion, supported the view that the early scientific training of medical students could be undertaken by public schools.

In his paper on the experimental determination of the equivalent of magnesium, Mr. W. M. Hooton explained the complex reactions which actually occur when magnesium is heated in a porcelain crucible. As usually performed, the products include, in addition to the oxide of the metal, magnesium nitride and silicide, carbon, and possibly silicon. We should like to see more papers of this type, for there are many text-book exercises in vogue, both in class and in examinations, which call for careful revision. Mr. Hooton did not only succeed in the analytical investigation—he further developed a revised and satisfactory manner of performing this quantitative exercise which is of considerable value in an elementary course.

A good discussion was evoked by Mr. Eggar's paper on teaching English in connection with science lessons. The opener and Mr. Lewis, who followed, dwelt mainly on the faults prevalent in boys' notes, but subsequent speakers offered constructive suggestions for improvement. Prof. R. A. Gregory asked that more prominence be given to the romance of science. Scientific work of the last ten years had been concentrated on the drudgery of the laboratory, and the inspiration of early days had been neglected. This neglect was detrimental to scientific progress, and he wished schools more effectually to cultivate interest in the higher aspects of science. Dr. Gow (Westminster) said that the difficulty in regard to accurate language was felt in every branch of school teaching. After a long and interesting debate, the chairman suggested the possibility of a correlation report, to be drawn up in association with teachers of English.

Another useful debate arose on the question of "Wave Theory *versus* Rays" in the teaching of light, the respective protagonists being Mr. J. Talbot and Mr. C. F. Mott. Dr. T. P. Nunn uttered a needed *caveat* against dogmatic exposition of ideas relating to the æther, and showed how simply some of the most useful formulæ of optics could be obtained by heuristic lessons without unverified assumptions. The outcome of the discussion appeared to us to be that it was possible to secure the presentation of useful concepts of the wave theory to a class of boys of age sixteen, and that the process was valuable educationally.

Mr. R. W. Sloley contributed a paper on teaching concepts of energy and potential.

The exhibition of scientific apparatus and books was of large extent and good quality. Twelve of the best known firms in the trade had arranged extensive exhibits, which included not a few novelties. There were also about forty pieces of apparatus contributed by the members of the association, in some instances the handiwork of pupils. Half a dozen leading publishers sent their latest books on science subjects, and it was satisfactory to note the large proportion of advanced books which were shown. Most of the members and guests devoted a considerable time to the examination of the exhibits, which were well displayed, and suggested many practical aids to work in laboratory and lecture-room.

In promoting social intercourse among science and mathematical masters from various parts of the country, this year's congress was even more successful than its predecessors. Much of the credit for this must be given to Mr. D. J. P. Berridge, who is retiring from the office of honorary secretary after giving to the Public School Science Masters' Association several years of hard, successful work. G. F. D.

GEOLOGY OF THE BRITISH ISLES.

AMONG the later memoirs of the Geological Survey of Great Britain, for which Mr. T. Fisher Unwin is wholesale agent, is that accompanying Sheet 142 of the 1-inch map, on "The Geology of the Melton Mowbray District and South-east Nottinghamshire," by Messrs. Lamplugh, Gibson, Wedd, Sherlock, and Smith (price 2*s*. 3*d*.). The map (price 1*s*. 6*d*.) is a good one for showing the irregular distribution of boulder-clay across the ridge of Middle Lias, and its cessation in the Vale of Belvoir. Rhætic beds are recognised above the "tea-green marls" of the Keuper in the north and west. In the memoir it is pointed out that the Vale of Belvoir must have lain in the glaciated region, but was an area of stripping rather than of accumulation. Melton Mowbray probably stands over a concealed coalfield, which has been proved by borings to the north-west, and which may extend far to the south-east.

The tenth part of "The Geology of the South Wales Coalfield" has also been issued by the Survey, and is written by Messrs. Strahan, Cantrill, Dixon, and Thomas (price 2*s*.). It accompanies Sheet 229 of the map, which appears both in "solid" and drift editions. Part of the area was surveyed by Mr. B. S. N. Wilkinson, now senior geologist on the Irish Survey. The features of economic importance are dealt with in the description of the coalfield, which appears in the south-east of the map, and in chapter xv., on metallic ores, building stones, &c. The subdivisions of the Ordovician strata, including the Llanvirn series, are now shown in considerable detail on the colour-printed map, and Upper Tremadoc beds are also recognised in a band south of Carmarthen town. The Old Red Sandstone makes distinctly hilly country along the coast, and is cut across its strike by the main streams. The journey westward from Kidwelly thus involves two picturesque but sometimes breezy ferries, while the railway runs in milder Ordovician country to the north. The drift map shows patchy remnants of a sheet of boulder-clay, deposited by ice moving westward and southward down the Towy Valley, but disregarding its local windings. In the extreme west of the area ice probably came in from the north-west. It is suggested (p. 147) that the chalk-flints which are fairly common in the glacial gravels were derived from Cainozoic deposits which have been swept away.

Messrs. Lamplugh and Gibson have described "The Geology of the Country around Nottingham" (1910, price 2*s*.), with an accompanying map, specially composed of parts of four sheets (price 1*s*. 6*d*.). Attention is directed to points where local research is still required, a feature of the memoir that will be welcomed in a district famous for its amateur geologists. This official work has, indeed, been undertaken in an educational spirit, and is certain to meet with a gratifying response.

Mr. H. J. Osborne White writes on "The Geology of the Country around Alresford" (1910, price 2*s*.), and a colour-printed reproduction (price 1*s*. 6*d*.) is now issued of the drift-sheet No. 300, first published in 1898. The district lies on the edge of the chalk of Salisbury Plain, which is followed so picturesquely on the east by the high commons of the Lower Greensand beyond Lyss and Kingsley. A memoir describing the country that includes the village of Selborne, nestling in its vale at the foot of the Lower Chalk escarpment, will appeal to many naturalists. Mr. O. White pays special attention to the zoning of the Chalk. Types of soil and questions of water supply are dealt with in the concluding pages, and there are some interesting notes on river-capture (pp. 74 and 75).