bromide dry plates upon the market. These "London" plates were remarkable for their fine quality although made entirely by hand.

Mr. Wratten was also a pioneer in 'instantaneous' photography by taking advantage of the superior sensitiveness of gelatine over collodion plates. In 1882 he photographed the University boat race, and he was the first to photograph the Derby. As soon as gelatine plates became fairly well established, Mr. Wratten started a plate factory at Croydon, and he lived there for the last forty-six years of his life. In 1896 the shop and premises in Great Queen Street were closed. In 1906 Dr. Kenneth Mees joined the firm, and in 1912 the Kodak Company bought the business. Dr. Mees went to Rochester, New York, to establish and conduct the research laboratories there, and Mr. Wratten's son, Mr. S. H. Wratten, became the head of a technical department of the Kodak Company.

News and Views.

ON March 9 Dr. Arthur Wade read a paper before the Institution of Petroleum Technologists in which he embodied the results of his experience of oil exploration in Australia and Papua. As he pointed out, in no part of the world have the Government and people of a country been more anxious to obtain indigenous supplies of petroleum than in Australia, but so far this natural desire has not been realised. Many geologists have concluded, and with good reason, that owing to the fundamental character of the Australian continent, and its similarity to the great Archæan shields of the earth's surface, it lacks either the marine sedimentary cycles or the tectonics with which one associates the main oilfields of the world; hence the chances of locating large oil-pools are remote. The author felt that this was a dangerous generalisation for a continent, though he admitted that very large areas in Australia were distinctly unfavourable to the occurrence of oil; he stated "the close study of a few areas of comparatively limited extent leads one to the conclusion that commercial pools of oil do occur elsewhere in association with conditions . . . (characterised by) . . . the presence of abnormal factors which operate locally and are not usually active in productive oilfield areas."

DR. WADE dealt with the various direct and indirect indications of oil in the continent of Australia, but it cannot be said that in any one instance these amount to much: South and Western Australia have nothing to offer which can be construed as being in the slightest degree favourable. Of the Northern Territory he says: "Copper, gold and tin are more certain of providing the prospector with adequate returns for his work than is petroleum." The possibilities of Queensland seem to be based on the historic find of natural gas in a water-well at Roma in 1897; but subsequent drilling has not proved successful. In New South Wales an application of the American 'carbon-ratio' hypothesis has directed attention to the Sydney coal basin; but the author himself dispelled optimism in prospects here by his careful scrutiny of the data, though he considers the chances of locating natural gas favourable. In other parts of the continent very little is known of the geological conditions, save in broadest outline, though there is apparently little to commend them as potential oil-producing areas. With regard to Papua, geological circumstances are entirely different from those of the Australian continent, and chances of locating commercial pools are much more favourable; conditions of exploration and operation are extremely difficult in this territory, but past developments have not been without some success, and now that the Government has recently abandoned its monopoly to drill, private enterprise may well be productive of satisfactory results in the course of time.

SIR JOSEPH THOMSON gave the Kelvin Lecture to the Institution of Electrical Engineers on April 22. He chose as his subject the mechanics of the electric field, a subject, he said, which was never long absent from Kelvin's thoughts. He pointed out that the ordinary laws of electro-magnetism and of the dynamics of the electric field merely represent the relations between averages taken over a time which, though small, is finite and comparable with the times that occur in the atom. These relations, however, are meaningless when times less than the times for which the averages have been taken are considered. When considering the orbits of electrons, the principle of the conservation of energy holds only when taken on the average. When electric waves are generated by an electron in an atom, the time constant of the force increases as the force becomes weaker. When the field is very intense, the time constant is very small and the ordinary equations hold. When electric radiation becomes weaker and weaker, a place is reached where the time constant is comparable with the period of vibration; when this occurs the radiation is reflected. It will not go out into space. The waves coming back to the electron will restore the energy to it which they originally received. This can be applied also to an electron revolving in an orbit and leads to a corpuscular theory of light. In this theory, light is regarded as travelling out in bundles, the energy in each bundle diminishing as it goes through space. Sir Joseph is of opinion that the isolated positive hydrogen atom may be capable of producing vibrations which are very short even when compared with the vibrations of Röntgen rays.

THE Perthshire Natural History Museum, which ranks high amongst local institutions of its kind, has been busy setting its house in order as regards its collection of Mollusca. Mr. Henry Coates has been occupied for some years past in amalgamating the interesting and important collections presented at different times by various donors, in arranging them for exhibition, and in preparing a catalogue, which is now published in the *Transactions of the Perthshire Society of Natural Science* (vol. 8). Mr. Coates has prefixed a brief history of the collection, the extent of

which may be gauged by the fact that the catalogue occupies some 75 pages in 8vo. In common with all curators he complains of the great difficulties encountered in the matter of classification and nomenclature, and bewails the lack of a thoroughly comprehensive book giving a complete survey of the Mollusca, which, as he remarks, has still to be written. Among the old and new authorities cited as consulted we should have thought that Pelseneer's volume in the Oxford "Treatise on Zoology" and Fischer's "Manuel" ought to have found place. Illustrations of the exhibition cases, explaining the structure and development of the Mollusca, are given and show how admirably this feature has been carried out. The legends to the plates, however, are not quite correct. It might have been expected that the home industry carried on at their very doors would have received special treatment; but though illustrations of the old and present methods of fishing for the pearl mussel in the Tay are given, no exhibit of the growth and development of the mollusc is mentioned, an omission which certainly should receive prompt attention, since, as Dr. Boycott pointed out in these columns (NATURE, vol. 114, 1924, p. 276), there is a gap in our knowledge thereof which requires filling, and, if anywhere, it could be made good at Perth.

THE fourteenth International Geological Congress will assemble at Madrid on May 24-31. The principal subjects to be discussed are: (1) phosphates and pyrites, (2) geology of the Mediterranean, (3) Cambrian and Silurian fauna, (4) geology of Africa and its relation to that of Europe, (5) Tertiary vertebrates, (6) Tertiary Foraminifera, (7) Hercynian folds, (8) metallogeny, (9) vulcanism. There will be excursions before the meeting to the Straits of Gibraltar, the Mountains of Ronda, Linares and Huelva, the Guadalquivir, the Sierra Morena and Sierra Nevada, Burgos, the Canaries; during the meeting, to Almaden, the Guadarrama Mountains, Aranjuez: and after the meeting to the collieries of Asturias, the iron deposits of Bilbao, Catalonia and the Central Pyrenees, Catalonia and the Eastern Pyrenees, and the Balearic Islands. Any one desiring to take part in the Congress must apply to the Secretary of the Executive Committee of the Fourteenth International Geological Congress, Escuela de Minas, Calle de Rios Rosas, 5, Madrid, Spain, and enclose a remittance of 30 pesetas. A deposit is also required from those taking part in any of the excursions. Arrangements have been made for reduced railway fares to and from Madrid for members of the Congress on the Spanish railways, on the production of a special certificate issued by the Congress.

THE issue of the *Journal of the Royal Society of Arts* for April 2 contains a paper on domestic heating by Dr. Margaret Fishenden, of the Fuel Division of the Research Department, in which the relative costs of different systems of heating are compared. Taking good household coal at 50*s.* a ton, coke at 40*s.*, coal-gas at 10*d.*; a therm, and electricity at 2*d.* a unit, the prices of a therm are, for coal, 1·9*d.*; coke, 1·7*d.*; gas, 10*d.* and electricity 59*d.* For central heating, coal and coke appliances have an efficiency of 50 per cent., while gas and electricity appliances have 100 per cent. The costs of the same amount of heat effect are therefore in the ratios 1 : 0·9 : 2·6 : 15·5, and coke is the most economical. For heating by radiation from a body at high temperature, open fires have an efficiency of about 25 per cent., gas fires about 50 per cent., and electrical radiators nearly 100 per cent. The relative costs of equal heat productions in a room are coal, 1*d.*; coke, about 0·75*d.*; gas, 2*d.*; and electricity, 7*d.* Labour-saving, cleanliness, intermittent use and comfort have to be considered in addition to cost, and in the discussion it was stated that for one person using fires intermittently, gas is as cheap as coal.

SOUTHPORT meteorological observations for the year 1924 have recently been published by the Southport Corporation and the Meteorological Office, Air Ministry, the Fernley Observatory being now auxiliary to the Meteorological Office. Observations at Southport have been continuous for more than fifty years, so that the averages of temperature and rainfall are excellent for a health resort, and the observer, Mr. Joseph Baxendell, who is meteorologist to the Corporation, ranks amongst the foremost observers in meteorology, and commonly introduces material of much value into his annual report. The outstanding feature of 1924 is said to be a record frequency of southerly winds, and in consequence the year was very dull, decidedly wet, and fairly warm. The only months noteworthy for trying 'cold' winds were February and March. Due northerly winds were of less than normal frequency in every month except February. December was one of the mildest ever experienced. Though 1924 was wet it was less so than in many districts; there have been quite a number of wetter years and several more dull since observations were established in 1871; five of the twelve months were drier than usual, the run of rainy weather from July to October being very unfortunate. Only three months were brighter than is customary, almost the whole of the year's large shortage of sunshine occurring during the summer half year. In the appendix to the report for 1924 the periodicity for a small number of years is given from the harmonic analysis of 53 years' records of Southport rainfall. This is rather bold for a health resort. July and September of 1926 are both approximate dates of maxima rainfall, the earlier of periodicity 2·85 years, the later 2·19 years; the value of the forecast can soon be proved.

AT a meeting of the Illuminating Engineering Society on April 29 a paper on "School Lighting (Modern Requirements and Recent Progress)" was read by Dr. James Kerr, who is chairman of the Joint Committee formed by the Society to inquire into this subject. Since the reports issued by this Committee in 1913, substantial progress in illuminants and lighting appliances has been made. The importance of adequate access of daylight has been emphasised by the recent recognition of the part played by ultraviolet radiation in sunlight in relation

to health. For artificial lighting the Committee originally recommended a minimum of 2 foot-candles. Dr. Kerr suggested that in view of recent progress a value of 5-7 foot-candles should now be aimed at. He also emphasised the desirability of extra lighting of the blackboard, and proposed a general recommendation that sources within the direct range of vision should be toned down to 3 candles per sq. in. Dr. Kerr mentioned favourable experience with a local lamp equipped with daylight-glass so as to remove excess of red-yellow light, and he suggested that the use of suitable light-filters in schools for myopic children deserved investigation. Dr. E. H. Nash (Medical Officers of Schools Association) presided. Various representatives of educational bodies took part in the discussion, in which the importance of adequate lighting, both natural and artificial, in schools was strongly emphasised.

A LECTURE given by Mr. C. E. R. Sherrington on "Rail Transport Systems of the United States" has been published in the March number of the *Journal of the Institute of Transport*. The lecture is a useful one, as it emphasises the great difference there is between rail transport in Britain and in America. With the exception of rubber and coffee the United States is practically self-supporting. Its trade is therefore mainly internal. But in order to benefit by large-scale production in steel and similar industries where overhead charges form a large fraction of the total, the surplus is exported abroad. This has the effect of cheapening transportation and tends to concentrate large-scale industries. The opening of the Panama Canal and the agricultural depression had serious effects on the Chicago to Pacific coast lines. The Chicago, Milwaukee and St. Paul Railway was forced into receivership. This was unfortunate, as this road had electrified 648 miles of its main line through the Rockies down to the Pacific coast in 1920, and to opponents of electric traction the effect produced seems to be due to this cause. In reality the traffic through the north-western States did not warrant the building of three trans-Rocky mountain lines. Electrical engineers are studying closely the working of the new Diesel electric engines. If these prove satisfactory they will serve as a deterrent to further electrification.

THE report for 1925 of the Director of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington records a fruitful year's work. The Department has co-operated with other American research institutions in the investigation of the conducting layer in the upper atmosphere by means of reflection of wireless waves, and the results obtained seem to be in accord with those obtained in Great Britain by Appleton and Barnett, and Smith-Rose and Barfield. In co-operation with the Carnegie Institution Geophysical Laboratory, work is being done on the effect of pressure on the critical temperature of magnetisation; the results to date are confined to nickel, using pressures up to about 2000 atmospheres, but the effects seem to be very small: the research is of interest in connexion with the depth to which permanent magnetisation of ferrous rocks in the earth's crust can exist. The reduction of the observations of atmospheric potential gradient, made on the various cruises of the *Carnegie*, has made it possible to attempt, for the first time, the construction of isoelectric charts for the greater part of the earth's surface—the oceans. Several questions of purely atomic physics, not at present obviously related to geophysics, have also been investigated under the auspices of the Department. Much observational work in terrestrial magnetism and electricity has also been accomplished, particularly at the two observatories of the Department—at Watheroo, Western Australia, and Huancayo, Peru.

THE Report of the Marlborough College Natural History Society contains its usual lists of observations in natural history, meteorology, etc. A list of about 113 fungi of the district is given by C. P. Hurst and twelve flowering plants are added to the hand-list. The permanent record of the risings of the Rockley Bourn with a graph of the last twenty-four years is due to L. G. Peirson; it is a 'winterbourn' or 'hungerbourn,' a stream appearing in normally dry valleys in chalk country. Brentnall's account of the local Manor of Rockley is charming and quite suitable. A quite important and well illustrated paper on Cyclops, by A. G. Lowndes, records seventeen of the thirty British species in correlation with the *p*H value of the water in which they lived, and describes three forms; such systematic research should be published in a regular biological journal, or it will be missed by most workers.

DR. A. DAUVILLIER, of Paris, is to deliver the seventh Mackenzie Davidson Memorial Lecture before the Röntgen Society and the Electro-Therapeutics Section of the Royal Society of Medicine on May 20 at 8.15 P.M., taking as his subject "The Measurement of X-ray Dosage." The lecture will be delivered at the Royal Society of Medicine.

AT the annual meeting of the members of the Royal Institution, held on Saturday (May 1), the following officers were elected: *President*, The Duke of Northumberland; *Treasurer*, Sir Arthur Keith; *Secretary*, Sir Robert Robertson.

THE International Association for Psychology and Techno-Psychology (*i.e.* Industrial Psychology) began its official activity on March 15. Fifteen European countries are represented in the Association, the administrative headquarters of which are at Riga, under the direction of Dr. Moeller. In England the Association is represented by Prof. T. H. Pear, University of Manchester, and its department of Techno-Psychology by Dr. C. S. Myers, National Institute of Industrial Psychology. The first publication of the Association will be "A Survey of the Organisation and Position of Techno-Psychology."

WE regret that by a slip in our note on the explorations in Derbyshire caves (NATURE, April 24, p. 598), the name of the archæologist by whom the investigations are being carried out, was wrongly given. The work is in charge of Mr. A. Leslie Armstrong.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A professor of pure mathematics and a professor of chemistry in the Egyptian University, Cairo—The Director, Egyptian Education Office, 39 Victoria Street, S.W.1 (May 14). A public analyst for the Metropolitan Borough of Bethnal Green—The Town Clerk, Town Hall, Bethnal Green, E.2 (May 17). A head of the department of mechanical engineering and a lecturer in the department of civil engineering, architecture and building in Bradford Technical College—The Principal of the College (May 19). Junior assistants at the National Physical Laboratory with good honours degree and, if possible, research or technical experience in one of the following subjects: physics, electricity, metallurgy, engineering, aeronautics, naval architecture—The Director, National Physical Laboratory, Teddington (May 22). A professor of physics at the School of Engineering, Giza, Cairo—The Minister of Education, Cairo (May 30). An analyst in connexion with the Dairy Produce Act, 1924, in the Department of Agriculture, Irish Free State—The Secretary, Civil Service Commission, 33 St. Stephen's Green, Dublin (May 31). A bacteriologist in connexion with the Dairy Produce Act, 1924, in the Department of Agriculture, Irish Free State—The Secretary, Civil Service Commission, 33 St. Stephen's Green, Dublin (June 30). A director and an assistant director of the Research Association of British Paint, Colour and Varnish Manufacturers—Mr. J. B. Graham, 8 St. Martin's Place, W.C.2. A lecturer in geography and nature study at the Bedford Training College—The Principal. A resident tutor in geography at the Borough Road Training College, Isleworth—The Principal. A head of the chemistry department of the Huddersfield Technical College—The Director of Education, Education Offices, Huddersfield. A principal of the Derby Technical College—The Secretary, Education Committee, Becket Street, Derby.

Our Astronomical Column.

INVESTIGATION OF TRANSITS OF MERCURY.—Prof. Newcomb was the first to suggest that the unexplained fluctuations of the moon might really be fluctuations in the earth's rate of rotation. The suggestion can be tested by studying other heavenly bodies with rapid motion, notably Mercury and the inner satellites of Jupiter. Newcomb himself discussed transits of Mercury up to 1891, but failed to obtain definite confirmation of variation in the earth's rotation. *Union Observatory Circular* No. 65 contains a new investigation by R. T. A. Innes; he has repeated Newcomb's work, correcting a few minor errors, and has included the four recent transits of 1894, 1907, 1914, 1924, all well observed. The semi-diameters deduced for the sun and Mercury at unit distance are 959″·48 (0″·15 less than that of Auwers) and 3″·08. The latter is undoubtedly less than the real semi-diameter of Mercury, owing to irradiation.

A diagram is given of the time-residuals of the transits from 1677 to 1924; they are compared with Newcomb's diagram for the moon, and there is a certain similarity between them. Both have maxima near 1680 and 1885, and a minimum about 1780; the curve for Mercury between these limits is much more undulating than the lunar one. Jupiter's satellites I, II, are also used for the last thirteen years, and accord well with the Mercury curve in showing a rapid downward movement.

There is therefore a fair case for ascribing the errors in position of the different bodies to a common cause, namely, changes in the earth's speed of rotation. Dr. Innes seems to be in error in one point. He mentions the error of the equinox as due to a similar cause. But a shift of the sun along the ecliptic does not affect the position of the intersection of ecliptic and equator.

MASSES OF STARS OF TYPES F TO K.—*Astr. Nach.* No. 5434 contains an article on this subject by B. P. Gerasimovic. He points out how few stellar masses are accurately known, and how useful it would be to find a general method of obtaining them in the case of stars without visible companions. Two methods have been suggested; first, that of the equipartition of energy, which if established would correlate mass with velocity; secondly, Pannekoek's method from comparison of trigonometrical parallaxes with spectroscopic ones. The latter method is complicated by the effect of radiation pressure in diminishing gravitation, especially in the hottest stars.

The author bases his work on the Victoria parallaxes, and the masses of binaries with well-developed orbits. The equipartition principle is first tested; the quantity (mass) × (velocity)^2 is formed for a large number of stars of types F, G, K. The mean values of the product for the three types are 3·47, 3·45, 3·59, in good agreement with Seares's value 3·57 obtained in quite a different manner. It is concluded that both the equipartition theory and Pannekoek's principle are sound, and can be applied statistically, though there may be large deviations for individual stars.

Prof. Eddington's proposition of correlation of mass with absolute magnitude is then tested, graphs being drawn for the different types. They show large departures from linearity, there being evidence of discontinuity between M = 2·0 and M = 3·5, about the region of demarcation between giants and dwarfs.

The paper concludes with a list of deduced masses and densities of 74 stars with parallax 0·07″ or greater. The five largest masses are 61 Ursae Maj. 4·1, δ Eridani 3·7, 61^2 Cygni 3·5, η and γ Cephei each 3·0. 61^2 Cygni is given the great density 31·8; that of Arcturus is only 0·0005, its mass being 1·6. These data are only provisional, but they give hope of future increase of knowledge in this very important but difficult field.