

Petroleum.—Russia and the United States are the two great petroleum producers. In the British Empire, Canada and Burma are the only oil regions deserving mention at the present time, though their output is, comparatively speaking, small.

Salt.—The United States and the United Kingdom produce about 2 million tons of salt each, Russia $1\frac{1}{2}$ million, Germany $1\frac{1}{2}$ million, India about 1 million.

Silver.—Here again the United States are the largest producers, followed closely by Mexico. Australasia furnishes an output nearly equal to one-third of that of the United States, and Bolivia and Germany approximately the same amount.

Tin.—The Malay Peninsula is *facile princeps* as regards the production of tin, probably yielding nearly two-thirds of the world's supply; and when aided by other British Possessions fully three-quarters.

Zinc.—The mines of Upper Silicia alone would suffice to make the German Empire *par excellence* the zinc-producing country of the whole world. The United States, after a long interval, take the second place in the list.

It must be carefully remembered that many valuable minerals are not mentioned: for instance, Cape Colony produces diamonds to the value of $4\frac{1}{2}$ millions yearly; Italy has no equal for its sulphur, Chili for its nitrate of soda, Germany for its potassium salts, Spain for its quicksilver, and the United States for their phosphates.

ON THE ORIGIN OF MAGNETO-OPTIC ROTATION.¹

IT is known (*Phil. Mag.*, December 1897) that when in a material molecule there exists an independently vibrating group of ions or electrons, for all of which the ratio e/m of electric charge to inertia is the same, then the influence of a magnetic field H on the motions of this group is precisely the same as that of a rotation with angular velocity ω , equal to $\frac{1}{2}eH/mc^2$, imposed on the group around the axis of the field, on the hypothesis that the extraneous forces acting on the ions are symmetrical with respect to this axis. This result involves the main features of the Zeeman effect; it requires that the separations of the doublets representing the spectral lines arising from such a group must all be equal when measured in differences of frequency, or be inversely as the square of the wave-length in vacuum when measured in differences of wave-length, a relation which Preston has recently found to obtain for the natural series of lines in ordinary spectra.

The object of this note is to point out that it is possible to deduce the Faraday effect from the Zeeman effect by general reasoning, as regards any medium in which the optical dispersion is mainly controlled by a series of absorption bands for which the Zeeman effect obeys the above law, without its being necessary to introduce any special dynamical hypothesis. For this law ensures that the effect of the magnetic field on the periods of the corresponding free vibrations of the molecules is the same as that of a bodily rotation, say with angular velocity ω , round its axis;² while the complete circular polarisations of the Zeeman doublets, viewed in the direction of the axis, show that their states of vibration are symmetrical with respect to that axis. Thus, Ω being the angular velocity of the displacement vector in a train of circularly polarised waves traversing the medium along the axis, the state of synchronous vibration which it excites in the molecules will have exactly the same formal relation to this train when the magnetic field is off as it would have to a train with very slightly different angular velocity $\Omega \pm \omega$ when the magnetic field is on, the sign being different according as the train is right-handed or left-handed. Now, change of this angular velocity Ω means change of period of the light: thus the propagation of a circularly polarised wave-train when the field is on is identical with that of the same wave-train when the period is altered by its being carried round with angular velocity $\pm \omega$ and there is no influencing magnetic field.

This last result has been employed by H. Becquerel as a single hypothesis (suggested by Maxwell's notion of a magnetic field in this connection as a vortex in the medium) from which

¹ Communication to the Cambridge Philosophical Society, March 6, by J. Larmor, F.R.S.

² The circumstance that the mean of the two disturbed periods is equal to that of the undisturbed line shows that no effect of constitutive type is involved in addition.

to deduce quantitatively both the Zeeman effect and the Faraday effect, and thus correlate them ("Sur une interprétation applicable au phénomène de Faraday et au phénomène de Zeeman" — *Comptes rendus*, November 8, 1897). He shows, employing chiefly the quantitative results of his own previous experimental investigations, that the hypothesis is capable of providing a satisfactory general view of the whole range of the phenomena, and in particular that it leads immediately to a simple law of dispersion for the Faraday effect, namely rotatory power proportional to $\lambda dn/d\lambda$ where n is the refractive index corresponding to wave-length λ measured in vacuum, a law which is in good agreement with Verdet's results for carbon disulphide and creosote.

The preceding argument provides a general dynamical justification of this hypothesis, for the case of all media in which the ordinary gradient of dispersion is mainly controlled by one or more powerful absorption bands beyond the visible spectrum, for all of which the Zeeman constants are the same: it also shows that Becquerel's hypothesis has an approximate validity when these constants are nearly the same for all the effective bands. In the immediate neighbourhood of any single band the dispersion is anomalous, and is controlled practically by that band alone; the application will then be exact, and in Becquerel's hands it has given a complete account of the excessive and anomalous rotation first observed by Macaluso and Corbino in sodium vapour for light adjacent to the D lines. As was to be anticipated, these simple general conclusions are consistent with the results of the more special dynamical investigations of FitzGerald and Voigt.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

DR ROBERT MUIR, at present professor of pathology in the University of St. Andrews, has been appointed to the chair of Pathology in the University of Glasgow.

By the will of the late Miss Elizabeth Brown, who died on March 5, the British Astronomical Association will receive her observatory at Further Burton, with the astronomical instruments in it, and the sum of 1000*l*.

Science states that Mr. John D. Rockefeller has offered 100,000 dollars to Denison University, Granville, O., if the friends of the institution will, within the next year, raise the sum of 150,000 dollars.

THE British Child-Study Association has issued the first number of a magazine entitled *The Paidologist*, which is to be published three times a year, and will be concerned with the physical and psychological aspects of child-life. The aims of the Association are both scientific and educational; and the new magazine is intended as a medium in which the results of research on child psychology shall be recorded, and practical suggestions which will assist in the evolutionary progress of the race shall be described.

WITH reference to the Board of Education Bill, the Council of the Association of Technical Institutions has unanimously adopted the following resolutions: (1) In reference to Section 2 of Clause 3, "That, inasmuch as in some counties and in most county boroughs the funds available are already fully appropriated for the purposes of technical education it is not, in the opinion of this Council, desirable that these funds should be applied to the payment of the expenses of inspecting schools under this Section." (2) "That, in the opinion of this Council, having regard to the fact that the funds assigned under the provisions of the Technical Instruction Acts are not more than adequate for the maintenance and development of technical education, it is essential that for the further purposes of secondary education additional funds be provided." It has also decided to take steps to endeavour to secure that the interests of technical education shall be adequately represented on the consultative committee named in Clause 4 of the Bill.

THE Commissioners appointed under the University of London Act, 1898, have given notice that they are now prepared to consider applications from duly qualified teachers and lecturers giving instruction of the University type in public educational institutions situate within a radius of thirty miles from the University buildings, who desire to be recognised as teachers of the University. By a "public educational institu-