

proposed a theory for both effects as a problem of perturbation in electron orbits, and last August I presented the same at the International Mathematical Congress at Toronto.

In the simplest case of circular orbits due to a central force (Coulomb's force) represented by the equations in polar co-ordinates

$$\frac{d^2r}{dt^2} - r\left(\frac{d\theta}{dt}\right)^2 = -\frac{\mu}{r^2}; \quad \frac{1}{r} \frac{d}{dt} \left(r^2 \frac{d\theta}{dt} \right) = 0$$

we can introduce a perturbing force X due to a magnetic or an electrical field, and determine the variations produced in the characteristic quantities. For the primitive (non-perturbed) radius of the circular orbit, the X force introduces a correction ρ given by the equation

$$d^2\rho/dt^2 + n^2\rho = 3X \cos nt,$$

n being the average time of astronomers. We can integrate the equation in every hypothesis and deduce the variation of the periodic time n . Let X be the effect of a magnetic field H , then ρ results, $\rho = \pm evH/mcn^2$, e , v , m , c being well-known quantities, and the primitive periodic time becomes $n = n_0 \pm 3eH/2mc$, containing the explanation of simple Zeeman triplet.

If we assume the central force to be an elastic force, the solution becomes $n = n_0 \pm eH/2mc$, the well-known Lorentz's formula.

The more complex Zeeman effects may be deduced from elliptical orbits, and the solution gives also a displacement of perihelion in terms of classical methods.

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Science and Intellectual Freedom.

MR. WELLS'S letter in NATURE of July 25, p. 134, fails to notice a most important distinction. Knowledge concerning the origin of species may be, and usually is, honestly and honourably desired for its own sake without any view of practical application. Knowledge concerning contraception is sought, either from mere prurience, or from intention to practise it or to teach others to do so. Many who hold that the State has no right to control its members' thoughts hold that it has the right to control their actions; and such persons, if they hold (as I do not) that the prevention of conception is wrong, may oppose the propagation of knowledge which has no value except in so far as it leads to such prevention, without being insincere in their desire for intellectual freedom.

There are, of course, doctrines, especially in ethical, political and economic theory, the intellectual and practical values of which are so closely associated that it is difficult to decide into which class they fall. But the solution of the problems raised by these border-line cases—which are those that cause real difficulty—is not aided by a refusal to recognise that they are border-line cases, and that the classes which they separate are generally distinct and present no difficulty whatever to a judicial mind.

NORMAN R. CAMPBELL.

The Isotopes of Mercury.

THANKS to generous financial assistance, for which I am indebted to the Department of Scientific and Industrial Research, I have been enabled to build a mass-spectrograph giving double the dispersion of the one previously in use. The final adjustments of

this instrument are by no means complete, but it has already given results of great promise.

Preliminary photographs of the mass-spectra of mercury show its lines clearly resolved and so enable a definite statement to be made on the mass numbers of its most important constituents. These are six: 198 (4), 199 (5), 200 (7), 201 (3), 202 (10), 204 (2). The numbers in brackets indicate very roughly the relative intensity of the lines and, if we assume the whole number rule to be exact, correspond to an atomic weight in agreement with the accepted chemical one, 200.60. The possibility already suggested (*Phil. Mag.*, 49, p. 1196, 1925) that the mercury group might show a resemblance to that of cadmium is therefore borne out to some extent, although the extreme variation in the intensity of its lines appears rather less than in that element. On several of the mass-spectra obtained there are faint indications of other lines, but a great deal more work will have to be done before these are proved to be due to isotopes of mercury or not; in any case their proportions are comparatively insignificant.

These results have a direct bearing on the claims recently made that under special conditions mercury has been transmuted into gold by the addition of an electron to the nucleus. It is clear that if the gold were so formed it would have an atomic weight at least as high as 198, that is, perceptibly higher than that of ordinary gold, 197.2. A definite determination on this point would seem to provide conclusive evidence on this interesting problem.

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August 1.

Separation of the Depressor Principle from Hepatic Tissue.

THE action of water-soluble substances prepared from hepatic tissue in lowering the blood pressure of normal animals has been noted in the literature for many years. Investigations as to the chemical nature of this principle, which were initiated in this laboratory and the Department of Physiology eighteen months ago by Drs. James and Laughton, have yielded the following results.

The active principle is non-protein in character and is found in the abiuret fraction. It is soluble in water-alcohol solutions up to 80 per cent. strength. It is precipitated from aqueous solution by phosphotungstic acid along with the diamino acid fraction, and the material recovered in aqueous solution can be further purified by extraction with ether, which has the capacity for dissolving out a very active principle which depresses the arterial tension and maintains it at a subnormal level for a long period.

The depressor substance is associated with a pressor principle in the abiuret fraction. These two are separated during the treatment with phosphotungstic acid, since practically all the pressor element remains in solution.

Not only is the normal pressure reduced to subnormal levels but also artificial hypertension, induced by various well-known pressor substances, is similarly reduced to any desired level depending on the dose employed.

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