Letters to the Editor

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NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 559.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Rate of an Atomic Clock in Motion

ACCORDING to the theory of the relation between matter and the luminiferous ether, as developed by Larmor and Lorentz, a moving clock should assume the rate

$$v = v_0 \sqrt{1 - \frac{V^2}{c^2}},$$

where v_0 is the stationary rate, V the measured velocity of the clock with respect to the observer, and c the velocity of light.

It was pointed out by Einstein in 1907 that the newly discovered Doppler effect in canal rays offered a means for making a test of this prediction. This experimental test, the crucial nature of which has been emphasized repeatedly in the last thirty years (under the designation of the 'transverse Doppler effect') has not heretofore been performed. It has been commonly considered as beyond experimental practicability, chiefly on the ground that as the moving canal rays are not homogeneous in velocity, the 'displaced' line is too diffuse for sufficiently exact measurement.

This objection has recently been removed, due to the development, by Dempster, of a design of canal ray tube which gives displaced lines of a sharpness comparable with the undisplaced. In this form of tube, the positive ions produced behind the electrode are accelerated between two slightly separated pierced plates between which a high potential difference exists.

Recently, with the assistance of Mr. G. R. Stilwell, I have made an experimental test of the Larmor-Lorentz prediction, using canal ray tubes of the Dempster type. The hydrogen line 4861 Å. has been used, observations being made by means of a plane grating of metal on glass of 15,000 lines to the inch, made by Prof. R. W. Wood, which, in conjunction with two 5-in. diameter, 5-ft. focus telescope objectives, formed a sufficiently powerful spectrograph for the purpose. By means of a small concave mirror mounted on the pierced electrodes, end-on observation gave, on one plate, the displaced lines due to motion toward and away from the spectrograph slit. The apparatus was arranged to turn in any desired direction in the horizontal plane.

For the voltages used, which were about 18,000, the displaced H_2 lines, which were the most feasible for study, should, according to the theory, have their common centre of gravity displaced, with respect to the undisplaced line, by approximately 0.05 Å. towards the red, which is readily detectable with the dispersion employed.

The result of the experiment was to show a displacement in the predicted direction, independent of the orientation of the apparatus, and agreeing, within the errors of measurement, with the value indicated by theory.

The importance of this experiment lies in the fact that it yields a positive effect, as distinct from the null effects obtained in other optical experiments, which latter might be explained by an entrained ether. It is therefore decisive in favour of the Larmor-Lorentz theory.

A full account of the experiment will be published shortly.

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Effect of Solvents on the Absorption Spectrum of Vitamin A

It has long been known that some substances, for example, indigo, yield variously coloured solutions in different solvents. Change of solvent may affect the intensity and position of absorption maxima in the ultra-violet as well as in the visible spectrum. The fact that this phenomenon has been observed with a related substance, carotene, makes it the stranger that various solvents are commonly accepted as interchangeable for the spectrophotometric assay of vitamin A. Thus ethyl alcohol and cyclohexane received equal sanction at the 1934 International Vitamin Conference and in the 1936 "Addendum to the British Pharmacopœia"; ether is also used in some laboratories, but chlorinated solvents, particularly chloroform, have been regarded with suspicion.

We now find that the vitamin A absorption bands of fish-liver oils and concentrates may vary some-

Substance	$E_{1\text{cm.}}^{1\%}$ 328 mμ in alcohol	Absorption at 328 mμ relative to 100 for alcohol				
		Alcohol	Cyclohexane	Hexane	Ether	Chloroform
Halibut-liver oil 12/136	40.8	100	99	102	110	93
Halibut-liver oil 12/214	30.1	100			116.5	93.5*
Fish-liver oil 11/323	52.7	100	97	95	99.5	85.5
Concentrate 12/099	630	100	99	96.5	105	86.5
Concentrate 12/168	480	100	95.5	97	106	86
Average		100	97.5	97.5	107.5	89

* One determination only.

what with change of solvent, both in position and in magnitude. The values of $E_{1\text{cm.}}^{1\%}$ 328 mμ, for three oils and two concentrates, in five solvents are summarized in the accompanying table. For ease of comparison, the values in solvents other than alcohol are expressed as percentages of the absorption in alcohol. Each figure represents the mean of two to four highly concordant independent determinations. Consistently higher results were obtained with alcohol than with cyclohexane or hexane as solvent, and we believe that the differences have real significance.