equation; it will be seen that this line is tangential to the extrapolated curve drawn through the experimental points. A good straight line is obtained by plotting $(\phi - 1)/\sqrt{c}$ against $\sqrt{c}$ (*vide* Jones and Dole) and its intercept on the axis of zero concentration is -0.0052 , in satisfactory agreement with the value of -0.0046 predicted by the Dole-Falkenhagen equation. The values obtained in the silica viscometers are less concordant but indicate clearly the existence of relative viscosities greater than unity over the same concentration range as that indicated above. It is possible that measurements made with a capillary viscometer at these high dilutions are materially affected by some sort of electro-kinetic effect which will vary with concentration; it is possible, for example, that specific ion adsorption in the capillary may produce an electrical 'drag' on the flowing liquid. It is for this reason that we are carrying out measurements in both silica and glass viscometers.

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¹ Jones and Dole, *J. Amer. Chem. Soc.*, **51**, 2950; 1929. Dole and Falkenhagen, *Physikalische Zeitschrift*, **30**, 611; 1929.

Raman Spectra of Some Triatomic Molecules.

It was observed by me¹ and also independently by Dickinson and West² that liquid sulphur dioxide gives three Raman frequencies. The measured wave-number shifts were 526, 1146, and 1340, the line corresponding to 1146 being much more intense and sharper than the two others. The spectrum of sulphur dioxide gas has since been successfully photographed by me and exhibits a frequency 1154, which is distinctly greater than the value 1146 obtained with the liquid and agrees much better with the infra-red value 1152 found for the gas by Bailey, Cassie, and Angus.³ The two other lines are presumably too weak to be recorded in the case of the gas.

The spectrum of liquid hydrogen cyanide has also been photographed by me and shows a triplet giving the frequency shifts 2076, 2097.2, and 2122, of which the middle component is much more intense than the others; its value 2097.2 is probably accurate to within ± 0.2 . Dadiou and Kohlrausch give it as 2092 and do not record its companions.⁴ It is interesting to note that Barker,⁵ working with hydrogen cyanide gas, found the corresponding infra-red absorption band at 4.7μ to be a triplet, the maxima appearing on his curves at 2088, 2103, 2117 wave-numbers, in each case only a few units different from the values reported above for the liquid.

The case of carbon disulphide has been the subject of investigation by several authors. Krishnamurti found recently⁶ that the intense line at 655 has a feeble companion at 647, and that the line at 800 is also diffuse. His results have been confirmed by me, and in addition three new very feeble bands at 4438, 4605, and 4680 A. have been discovered in the spectrum of carbon disulphide excited by the mercury line 4358.3 A. when photographed with long exposures. If these are assumed to be due to Raman transitions, they give us three new characteristic frequencies of carbon disulphide, namely, 412, 1229, and 1577.

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¹ *Ind. Jour. Phys.*, **5**, 35; 1930.

² *Phys. Rev.*, **35**, 1126; 1930.

³ *NATURE*, **126**, 59; 1930.

⁴ *Berichte*, **63**, 1657; 1930.

⁵ *Phys. Rev.*, **23**, 200; 1924.

⁶ *Ind. Jour. Phys.*, **5**, 105; 1930.

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Dangerous Properties of Ethylene Chlorhydrin.

In the issue of *NATURE* for Sept. 8, 1928, p. 376, appeared a note on a paper by Mr. F. E. Denny read at the annual meeting of the Society of Chemical Industry in New York, in which he advocates the use of ethylene chlorhydrin for speeding up the sprouting of potatoes, and in which it was indicated that the use of this substance is quite safe from the point of view of the workmen applying it.

During the course of its work in connexion with safety in chemical factories, the Association of British Chemical Manufacturers has recently had brought to its notice (*Zentr. Gewerbehygiene*, 1927, **4** (9), 712) information indicating that this substance possesses unsuspected toxic properties, and that several deaths have occurred in Germany from inhaling the vapour. A somewhat similar case with a fatal termination is reported, for the first time in Great Britain, in the annual report of the Chief Inspector of Factories and Workshops, 1930, p. 95.

The substance apparently acts as a metabolic poison with a specially severe effect on the nervous system, producing muscular weakness, inertness, refusal of food, sleepiness, and finally death by paralysis of respiration.

In view of the increasing use of this substance as a solvent for resins, wax, cellulose, and in the lacquer, paint, and pharmaceutical industries under conditions encouraging evaporation, it seems advisable to direct attention to the above observations, particularly as the substance itself is apparently innocent of all dangerous properties and its action is for that reason all the more subtle.

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Determinism.

THE implications of Heisenberg's principle of uncertainty are often seriously confused owing to the ambiguity of the expression 'to determine'. In the present connexion this should mean 'to cause'; what further meaning should be assigned to 'cause' itself is here immaterial. Among other physicists, Prof. G. P. Thomson asserts in "The Atom" (p. 190) that "physics is moving away from the rigid determinism of the older materialism into something vaguely approaching a conception of free will". In any such statement 'determinism' appears to have the sole meaning of 'unvarying causation', apart from which 'free will' is totally irrelevant. Most unfortunately, however, 'to determine' often means merely 'to ascertain', as when we say we cannot 'determine' the exact state of the case. On pp. 193, 194, then, Prof. Thomson substitutes this alternative meaning: "velocity is quite uncertain. A similar result applies if we try to determine the velocity of the electron. . . . There is an exact reciprocity between the exactness with which position and momentum can be determined." Here 'to determine' plainly means not 'to cause', but simply 'to ascertain'. But every argument that, since some change cannot be 'determined' in the sense of 'ascertained', it is therefore not 'determined' in the absolutely different sense of 'caused', is a fallacy of equivocation.

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