

monoxide, methane, etc., the ignition of which does not occur until much higher temperatures have been attained.

This hypothesis finds support in work carried out at the Leningrad Institute of Chemical Physics. Thus Kovalsky² has found that at low pressures the oxidation of methane is accompanied by the formation of carbon monoxide in large quantities. Sadovnikov³ has recently shown that at low pressures, during the inflammation of ethane-oxygen mixtures, carbon monoxide accumulates and then explodes.

From our own experimental results, we are able to apply the above hypothesis, used for butane mixtures, to pentane mixtures. The existence of a sudden lowering of the inflammation temperature at any critical pressure may therefore be considered to be quite general for the inflammation of complex hydrocarbons.

It is possible that this fact is closely connected with the increased probability of knock with increase of compression ratio in internal combustion engines.

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¹ Townend and Mandelkar, *Proc. Roy. Soc., A*, **141**, 484; 1933.

² Kovalsky and others, *Phys. Z. der Sowjetunion*, **1**, 451; 1932.

³ Sadovnikov, *Phys. Z. der Sowjetunion* (in print).

Raman Spectrum of Heavy Water

THE Raman spectrum of 80 per cent heavy water obtained with a sample supplied by Prof. H. S. Taylor of Princeton, when compared with the spectrum of the 18 per cent material previously reported¹, shows that the water molecule with two atoms of heavy hydrogen gives a Raman band with a frequency difference of 2517, while the molecule with one atom of heavy and one of light hydrogen gives two bands, one of frequency difference of 2623, the other of 3500. Ordinary water gives a band with frequency difference 3445. A single photograph of a sample of given concentration does not bring out this shift as the bands overlap; but by superposing the two photographs taken with different concentrations, the shift in the centre of gravity of the bands comes out in a very striking manner.

Preparations have now been made for photographing the spectrum of the vapour, in which case we shall doubtless find double lines in place of the superposed and slightly shifted bands.

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Jan. 2.

¹ NATURE, **132**, 970, Dec. 23, 1933.

Molecular Polarisation of Nitrobenzene in Various Solvents at 25° C.

A STUDY of the dielectric constants, densities and refractivities of dilute solutions of nitrobenzene in various solvents at 25° C. has been made in these laboratories with the following results:

Solvent	ϵ	∞P_E c.c.	∞P_{A+O} c.c.	μ
n-Hexane	1.897	372.5	389.9	4.049×10^{-18} E.S.U.
cyclo-Hexane	2.016	360.0	327.4	3.974 "
Dekalin	2.162	352.9	320.3	3.930 "
Carbon tetrachloride	2.228	353.1	320.5	3.932 "
Benzene	2.273	353.8	321.2	3.936 "
Carbon disulphide	2.633	310.0	277.4	3.658 "
Chloroform	4.722	241.2	208.6	3.172 "
		$\infty P_E = 32.6$ c.c.		

where: ϵ = dielectric constant of solvent, ∞P_E = total polarisation of nitrobenzene at infinite dilution, ∞P_{A+O} = atom + orientation polarisation, ∞P_E = electron polarisation, and μ = apparent electric moment calculated from the Debye equation neglecting the unknown atom polarisation. The error of measurement of the polarisations is probably ± 0.5 c.c.

If ∞P_E for all these solvents is plotted against ϵ , a reasonably straight line is obtained, the polarisation of the solute falling with increasing dielectric constant of the solvent. It is to be noticed that the table contains a polar solvent, chloroform. Non-polar solvents have dielectric constants between 1.8 and 2.6 approximately, and possibly polar solvents of higher dielectric constants may prove as serviceable for the measurement of apparent dipole moment as non-polar ones. The right conditions for the accurate determination of the dipole moment of a molecule in solution has yet to be found. In the past the Debye equation deduced for a gas has been slavishly applied. It may not be valid for a solution.

A more detailed account of this work will be published later.

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Integral Right-angled Triangles

IN NATURE of September 9 and October 14 integral right-angled triangles have been discussed. It is of interest to note that in the general solution

$$2fg; f^2 - g^2; f^2 + g^2,$$

if we make f and g consecutive terms of the series

$$1, 2, 5, 12, 29, 70 \dots$$

where $U_n = 2U_{n-1} + U_{n-2}$

we get triangles whose sides about the right angle differ by unity.

The first five triangles are

4	3	5
20	21	29
120	119	169
696	697	985
4060	4059	5741

The first one is used extensively by surveyors and others when constructing a right angle either on the ground or on a plan. The second, however, is a better 'conditioned' triangle and would be used if it were more generally known.

The law of formation of the series given above is the same as the law for forming successive convergents of $\sqrt{2}$ from the continued fraction.

Successive approximations to $\sqrt{2}$ can be obtained by dividing the hypotenuse by the mean of the other two sides of the triangles given here. If we take the fifth triangle and divide 5741 by 4059.5, we get $\sqrt{2}$ correct to one part in a hundred million.

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