of the rate constant is $k = 3 \times 10^{13} e^{-35400/RT}$ sec.$^{-1}$, and the close agreement with the above figure shows that the mechanism of the inverse diene synthesis is the same both in solution and in the pure liquid state.

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[1] NATURE, 137, 496 (1936).

THE formation of di*cyclo*pentadiene from *cyclo*pentadiene is a diene synthesis and the reaction is bimolecular in benzene[1] and in paraffin solution.

If rate measurements in the pure liquid state are carried out it has to be considered that the 'solvent' originally present (*cyclo*pentadiene) is changed into a new solvent (mixture of *cyclo*pentadiene and di*cyclo*pentadiene). Hence it is not surprising that in each run a gradual change of the bimolecular rate constant ($k$) is observed. The constants characteristic of pure *cyclo*pentadiene are obtained if the observed $k$ values are extrapolated to zero time. Both the extrapolated

constants and those observed in benzene or paraffin solution obey the Arrhenius equation. The 'temperature independent factors' ($Z$) and the activation energies ($E$) are given in the accompanying table.

| Reactants | Solvent | $Z^1/\text{gm.mol.sec.} \times 10^{-6}$ | $E$ kgm.cal. |
|---|---|---|---|
| *cyclo*Pentadiene | Benzene | 1·2 | 16·4 |
| *cyclo*Pentadiene | Paraffin | 13 | 17·4 |
| *cyclo*Pentadiene | *cyclo*Pentadiene | 0·4[2] | 16·1[2] |

The accuracy of $E$ is 5–10 per cent. It can be seen that the $E$'s agree within the limits of experimental error. Further, the $Z$ values and hence the collision numbers between solute-solute molecules and between solute-solvent molecules are of the same order of magnitude.

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[1] NATURE, loc. cit. ; *J. Chem. Soc.*, 1028 (1936).
[2] These values were calculated using unpublished measurements and the data given by Stobbe and Reuss, *Annalen*, **391**, 151 (1901), Barret and Burrage, *J. Phys. Chem.*, **37**, 1029 (1933) and Kistiakowsky and Mears, *J. Amer. Chem. Soc.*, **58**, 1060 (1936).

## Points from Foregoing Letters

THE use of contoured graphs for determining the configuration of atoms in crystals, from X-ray data, is explained and illustrated diagrammatically by Prof. W. L. Bragg. The analysis of atomic positions, it is claimed, can be more rapidly carried out with the graphs than by calculation.

The addition to serumalbumin solution of a protein (clupein) changes the sedimentation constant. The effect, according to Dr. K. O. Pedersen, is probably due to dissociation into molecules of perhaps one eighth the original size. This, the author considers, may be a general phenomenon which occurs with increasing concentration, even in solutions of a single protein, and may account for the abnormal increase in osmotic pressure with increased concentration of protein solutions.

A method of applying organic growth substances to plants by spraying is described by Dr. H. L. Pearse. Tomato plants sprayed with a dilute solution of phenylacetic acid showed increased growth in stem and petiole, with decreased growth in leaf and root.

Algæ of the genus *Valonia* form very large bladder-shaped cells. By X-ray, microscopical and optical investigation of the wall, it may be shown that sub-microscopical rod-shaped cellulose crystals (crystallites) are present. The wall consists of about forty lamellæ ; in the odd-numbered lamellæ all rods are parallel to each other, and in the even ones also, but in a direction which forms a large angle with the direction of the crystallites in the odd lamellæ. Prof. G. van Iterson, jun., gives an explanation of the way in which this structure is developed.

In connexion with the discussion on the origin of mimicry in insects, Prof. E. W. MacBride disagrees with the view that random inheritable variations in all directions constantly take place by chance. He considers that animals react to changes in environment and, when these are long continued, their effects are increasingly inherited by the offspring.

Diagrams showing the position of chromosomes during the metaphase stage of the reduction division (meiosis) in pollen mother-cells of *Silene Otites* are submitted by J. L. Fyfe ; they agree with the view of Dr. C. D. Darlington, that the configuration is determined by repulsion forces. Commenting on this communication, Dr. Darlington refers to additional evidence in support of his theory and states that the repulsions are inversely proportional to the distance.

A table giving the vibration spectra of several ethylenes containing heavy hydrogen ($C_2D_4$ and each of the three isomers $C_2D_2H_2$) is given by Prof. C. Manneback and A. Verleysen. The values were calculated from the known vibration spectrum of ordinary ethylene, by assuming that the 'potential function' is not altered when heavy hydrogens are present in the molecule.

The melting point, solubility, heat of combustion and dissociation constant of benzoic acid containing five heavy hydrogen atoms in the molecule are reported by Prof. H. Erlenmeyer and A. Epprecht.

No appreciable radioactivity has been observed by E. T. Booth and C. Hurst after irradiating, for periods varying from twenty minutes to six hours, substances containing various elements with neutrons of two million electron volts energy ; these were obtained by bombarding heavy hydrogen with heavy hydrogen ions, using total ionic currents of 100 microamp. and an accelerating voltage of 225 kv.

Hæmoglobin as found in blood corpuscles differs from the prepared 'laked' variety in that it does not show an absorption band in the ultra-violet at 4100 A. G. A. Adams, after investigating the effect of several substances, finds that the addition of stroma protein (stromatin) causes hæmoglobin to lose its absorption band at 4100 A., and concludes that hæmoglobin occurs in blood in combination with stromatin.