

The experimental value obtained by uni-molecular film measurements³ is 34 sq. Å., with a possible error certainly not greater than 2 sq. Å., so that the first and last structures are decisively eliminated. The elimination of the 8:14 structure is supported by the crystallographic structure of Bernal.³

(2) Danielli, Marrian and Haslewood, *Biochem. J.*, **27**, 311 (1933).

(3) Bernal, *Chem. Ind.*, **51**, 259 (1932).

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DIAMAGNETISM OF NITROSO COMPOUNDS

Sir:

Because organic nitroso compounds display certain anomalous properties, such as intense color and a marked tendency to form double molecules, G. N. Lewis¹ suggested that the explanation of their unusual behavior might be related to the cause of the peculiar properties of O₂ and NO, the former being paramagnetic and the latter showing little unsaturation, although it is an odd molecule. Pauling² proposed a structure for oxygen and nitric oxide involving the three-electron bond, which, therefore, in view of the above, led him to ascribe a similar triplet structure, $\text{—}\ddot{\text{N}}::\ddot{\text{O}}:$, to the nitroso group instead of the singlet configuration, $\text{—}\ddot{\text{N}}::\ddot{\text{O}}:$.

I have measured the magnetic susceptibilities of nitrosyl chloride (NOCl), of nitrosobenzene (C₆H₅NO), and of *p*-nitrosodimethylaniline ((CH₃)₂NC₆H₄NO), the first as a liquid, the second both as a solid and as a solute in benzene and toluene, the third as a solute in toluene. The Gouy³ method was used. All three compounds were found to be diamagnetic, a result which cannot be accounted for by the presence of any reasonable amounts of impurities, since the paramagnetism which would be exhibited if the molecules were in the triplet state would be too large to be so masked.

Likewise the result is not explicable on the basis of the formation of double molecules. The solutions were highly colored, a property which is definitely correlated with the monomeric state. Furthermore, investigation of toluene solutions of *p*-nitrosodimethylaniline, 1 to 7% by weight,

(1) G. N. Lewis, "Valence and the Structure of Atoms and Molecules," Chemical Catalog Co., Inc., New York, 1923, p. 128.

(2) Linus Pauling, *THIS JOURNAL*, **53**, 3225 (1931).

(3) E. C. Stoner, "Magnetism and Atomic Structure," p. 40.

with a Klett colorimeter showed that the depth of color was proportional to the concentration, indicating at least a high degree of dissociation into single molecules. Freezing point studies⁴ on nitrosobenzene in benzene lead to the same result.

The conclusion is that these compounds, at least, are in singlet states,⁵ which indicates that they do not have the similarity to oxygen previously suggested. Since at the present time there seems to be no theoretical basis for choosing between the singlet and triplet configurations for the ground state of this type of molecule, it is perhaps not worth while discussing reasons for the above experimental results. However, it is true that for each of the above compounds several singlet structures could be drawn which on the basis of energy data⁶ are known to contribute to the stability of related molecules through resonance and which have no triplet analogs. Such resonance would certainly tend to stabilize the singlet configuration but whether this is the determining factor cannot be stated.

I should like to thank Professor Linus Pauling for suggesting this investigation.

(4) K. Auwers, *Z. physik. Chem.*, **32**, 52 (1900).

(5) Linus Pauling, *THIS JOURNAL*, **53**, 1392 (1931).

(6) Linus Pauling and J. Sherman, *J. Chem. Physics*, **1**, 606 (1933).

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MUTAROTATION OF β -D-RIBOSE AND β -L-RIBOSE

Sir:

Owing to the importance of the little known sugar, ribose, not only in its structural relation to other sugars but also in its physiological relation to animal and plant life, since it appears to be of almost universal occurrence in tissues bearing upon the regeneration of life, Phelps and Bates a number of years ago undertook the preparation of a quantity of this sugar in order to study its properties and the improvement of the existing methods of production. One of us (Isbell) has been engaged for some time in the study of the composition of sugar solutions and in the investigation of the isomeric changes which follow solution in water, and has developed a method for determining the composition of the solutions by oxidation with bromine water. Since mutarotation of ribose is not reported in the literature