

condensate is vitreous and above which crystals are formed. Barnes has already established¹ that ice formed by the freezing of water at 0° C. exhibits

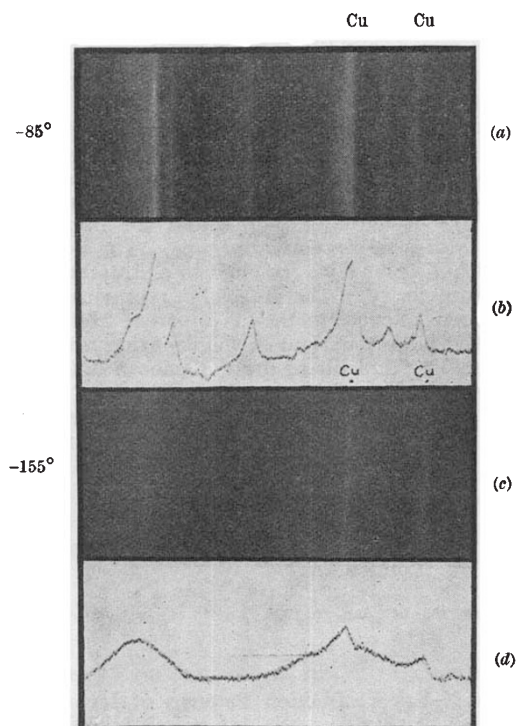


Fig. 1. X-ray diffraction patterns of ice from water vapour condensed at (a) -85° C., (c) -155° C., with corresponding microphotometer curves, (b) and (d).

the close-packed hexagonal structure and that no change takes place in the structure of ice between 0° C. and -183° C.

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¹ *Proc. Roy. Soc., A*, 125, 670; 1929.

Formation of Galactose in Vital Processes

SOME years ago, Prof. Robinson¹ put forward in these columns the ingenious suggestion that the conversion of glucose into galactose in the organism is a direct one and due to an inversion of the configuration of the groups attached to the fourth carbon atom of the glucose molecule, consequent upon esterification of the hydroxyl group concerned by phosphoric acid. It is, however, now recognised that the terminal carbon atoms, as distinct from the fourth carbon atom, are those which are esterified in the fructose di-phosphoric acid involved in biological processes, and that in these latter the acid suffers disruption into the phosphoric esters of *d*-glyceric aldehyde and dihydroxy acetone.

In these circumstances it is pertinent to recall first, the demonstration by Schmitz² that the α - and β -acroses resulting from Emil Fischer's classical synthesis of hexoses from *dl*-glyceric aldehyde (and dihydroxy acetone) are respectively *dl*-fructose and *dl*-sorbitose, and secondly, the interconvertibility, shown by De Bruyn and van Ekenstein³, of *l*-sorbitose (which, together with fructose, would result from combination of *d*-glyceric aldehyde with dihydroxy acetone) and *d*-galactose under the influence of alkali.

It may, therefore, be said that in principle a transition from *d*-glucose to *d*-galactose has been experimentally realised, and it may reasonably be asked whether Nature does not avail herself of these reactions for the conversion in question as well as for its direct synthesis in plants of one or both of these carbohydrates. Failure to detect trioses in plant products is no more conclusive against this hypothesis than was the difficulty in detecting formaldehyde. Again, whilst it is true that *l*-sorbitose has not been found in Nature, *d*-tagatose (which stands in the same relationship to *d*-galactose as fructose does to glucose) also has not been observed, and, on the other hand, *d*-sorbitose, but not *l*-galactose, does occur naturally. A more serious objection to a biological inter-relationship between *l*-sorbitose and *d*-galactose perhaps lies in the fact that the former does not seem hitherto to have been fermented.

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¹ *NATURE*, 120, 44; 1927.

² *Ber.*, 46, 2327; 1913.

³ *Rec. trav. chim.*, 18, 263; 1897; 19, 1; 1900.

Molecular Weights of the Phthalocyanines

THE accuracy attainable in determining the molecular weights of organic compounds from the density and cell dimensions of the crystal has recently been the subject of a note in these columns¹. It is well known, of course, that the crystal data can in general give only a maximum figure for the molecular weight. Thus in the relation:

$$\text{Molecular weight} = \frac{\text{volume of cell} \times \text{density}}{\text{number of molecules per cell}}$$

a knowledge of the space group enables us to state the maximum degree of symmetry that the individual molecule may contribute to the structure, hence determining the minimum number of molecules in the unit cell and consequently the maximum molecular weight. The true molecular weight will usually be a sub-multiple of this figure.

The metallic phthalocyanines² appear to offer an almost unique example of a class of compound in which an unequivocal determination of the true molecular weight can be made from the crystal data combined with an elementary analysis of the percentage of metal in the compound. The results have proved of considerable importance in deciding the structure of these compounds, because their low solubility renders the ordinary methods of molecular weight determination difficult or impossible to apply, except in the case of the magnesium compound³.

The compounds listed below all belong to the monoclinic system, and the space group $C_{2h}^2 (P2_1/a)$ is clearly established by the examination of many hundreds of reflections. The maximum symmetry which the molecule can contribute is thus a centre, and if we assume that they display this symmetry, then the number of molecules per unit cell is two, and we obtain the following figures for the maximum molecular weight.

	Nickel phthalocyanine	Copper phthalocyanine	Platinum phthalocyanine
<i>a</i>	19.9 Å.	19.6 Å.	23.9 Å.
<i>b</i>	4.71	4.79	3.81
<i>c</i>	14.9	14.6	16.9
β	121.9°	120.6°	129.6°
Mol. per cell	2	2	2
Volume of cell	1186 Å. ³	1180 Å. ³	1186 Å. ³
Density	1.63	1.63	1.98
Max. mol. weight	586	583	712