Ionic movements through quartz occur only in the < 0001 > direction and it is not clear why diffusion does not occur in other directions. Factors most likely to influence diffusion are the position of interstitial ions in the lattice, elastic moduli and piezoelectric vectors, all of which favour movement in the < 0001 > direction.

Alkali ions can enter quartz after crystallization, and, as I have diffused sodium and potassium ions from feldspar into quartz, other silicates and hydrothermal solutions can apply the necessary ions. The activation energies are high, but it must be remembered that piezoelectric voltages, although small, will be present in nature and will aid diffusion. The unique direction for ionic movement in quartz, and possibly in other silicates, will prevent diffusion in some crystals and may limit the extent of solid state metamorphic reactions. It is, however, a possible explanation of the coexistence of clear and smoky quartz (the latter is thought to be the result of natural irradiation on the former), because those crystals through which diffusion has occurred will not darken when irradiated. Also the possible natural movement of alkali ions from one crystal to another will introduce inaccuracies into geochronological dating methods which depend on the presence of these ions, because the theory of dating presupposes that ions neither leave nor enter the lattice after crystallization.

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Assignment of Absolute Configuration from Anomalous Dispersion by Oxygen Atoms

THERE have been several recent determinations of the absolute configuration of molecules using the anomalous scattering of X-rays by oxygen[1-3]. In each case, the Bijvoet anomalies, though small, were successfully detected in carefully measured intensity data.

We recently refined the structure of α-D-glucose monohydrate[4] $(C_6H_{12}O_6.H_2O)$ using 912 intensities (the unique set in reciprocal space), which were measured using Cu-$K\alpha$ radiation and a Siemens four-circle automatic diffractometer. The results will be discussed elsewhere, but at the stage at which the unweighted R had converged to 3·012 per cent and before the application of corrections for absorption and extinction, we decided— in view of the above reports and of the high percentage of oxygen in this structure—to examine the effect of allowing for oxygen and carbon anomalous dispersion. We used the values of $\Delta f'$ and $\Delta f''$ adopted by Hope and de la Camp[1,2]. Because no anomalous pairs were included in the measured data and the space group is polar $(P2_1)$, it is invalid to attempt least-squares refinement with a dispersion correction included, for then refinement tends to minimize the very differences one is looking for. So we performed a straightforward structure-factor calculation on both enantiomorphs, allowing for dispersion. Using the conventional absolute configuration and taking both $\Delta f''$ values positive, $R(+)$, which is the conventional unweighted R factor summed over all observed reflexions, was 3·524 per cent. On reversing the signs of both $\Delta f''$ values, equivalent to taking the reverse absolute configuration, $R(-)$ was 3·538 per cent. Hamilton's R-factor

significance test[5] showed that the one-dimensional hypothesis that the second (−) absolute configuration is correct can be rejected at about the 1·5 per cent confidence level. This was regarded as encouraging, bearing in mind that it was based on R factors derived from all reflexions in the unique set, and that some (probably small) corrections to the intensity data had still to be applied. To enhance the discrimination, and to make the procedure correspond more closely to that used in earlier work[1-3], 247 sensitive reflexions were selected whose calculated dispersion ratio diverged most markedly from unity. For this restricted set the corresponding R factors were

$$R'(+) = 5·073 \text{ per cent and } R'(-) = 5·769 \text{ per cent.}$$

Hamilton's test rejects the latter decisively ($\ll 0·5$ per cent confidence level), and hence confirms the conventional assignment of absolute configuration for α-D(+) glucose[6]. Although it had earlier been confirmed indirectly by studies of molecules incorporating known derivatives of D or L-glucose[3,7,8], this is the first direct demonstration for glucose itself. All are concordant.

It is evident that anomalous scattering effects from oxygen are sometimes significant and are then worth allowing for, but their influence on the usual overall R factor is slight, which is a further indication of the unsuitability of R as an index of progress in the later stages of refinement. The effects are often large enough to permit the assignment of absolute configuration. Preferably it should be based on direct measurement of a number of the larger Bijvoet anomalies (compare references 1-3), but, if it is attempted (as here) as an afterthought and on a unique set of intensities, the present results show that it is still feasible, and is best done on a limited set of "sensitive reflexions".

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Mechanical Pump with a Suction Lift of 17 Metres

AT sea level the pressure of the atmosphere will support a column of water about 10·4 metres high. At one time it was thought to be practically impossible for a suction pump to lift water to a height greater than this, but the construction and operation of a suction pump with a lift of about 17 metres have now demonstrated that this is not so.

The theoretical possibility of constructing such a pump has been evident for more than a century, ever since Berthelot[1] showed that liquids possess a considerable tensile strength and in certain conditions can therefore be subjected to a substantial negative pressure. Negative pressures in water as high as −280 bar have been generated by Briggs[2]. After more than half a century of controversy it now seems to be generally accepted[3,4] that negative pressures of the order of tens of bar exist in tall trees, where sap is sucked up by the topmost leaves from the