case is not analogous to racemic acid, for there is no enantiomorphism of the grossly material nuclei or inner swarms of electrons.

It need scarcely be added that the optically active sodium chlorate (or bromate) follows the above scheme and is in agreement with recent X-ray atomic models. The instantaneous racemisation on dissolution may well be attributed to the delicate nature of a purely electronic type of enantiomorphism.

The above suggestions are possibly open to the objection that they are too elusive to be put to an experimental test. This leads me to suggest material for future investigation, which may help towards a decision. The rhombohedral dithionates of calcium, strontium, and lead are usually quoted as having four molecules of water of crystallisation, thus, $PbS_2O_6, 4H_2O$. If this is really true, it would seem to follow that the crystal unit must contain six, if not twelve or even twenty-four, molecules of the salt, and that no successful elucidation is to be expected with present-day X-ray technique. But a rhombohedral crystal with four instead of three or six molecules of water almost amounts to a contradiction in terms, and the early analyses of these salts (ignition to an anhydrous sulphate) are perhaps not conclusive. A particularly simple crystal structure is consistent with a hexahydrated salt; in fact any eventual proof of a four-unit cell would determine the water content as securely as a chemical analysis. It is therefore conceivable that the structure is modelled on the calcite pattern (four molecules to the Bragg unit) according to the following scheme :

$$\ldots [6H_2O]Pb^{++} \ldots O_3S^-\text{------}SO_3 \ldots [6H_2O]Pb^{++} \ldots$$
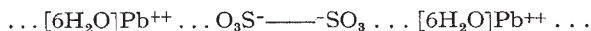
and that we shall have an X-ray pseudo-symmetry, the atomic assemblage appearing to have the symmetry of calcite, while the crystal structure has the symmetry of quartz, (the crystals are optically active, but not the solution). The rhombohedral (or hexagonal ?) anhydrous potassium salt may, perhaps, follow similar lines, but the crystallography is somewhat obscure.

No good purpose would be served by following out the consequences of a deformation of the RO_3 group into lower systems of crystallisation. Nor need the case of an RO_4 group be discussed, as it does not seem to offer any likelihood of pseudo-symmetry.

As previously indicated there is no such possibility of pseudo-symmetry as the above, when no atom, ion, or molecule occupies a specialised position in the structure. None is therefore to be expected in any of the 420 optically active structures previously mentioned. In theory, then, we have here another possible way of testing the above suggestions, but practical considerations, unfortunately, rule out any likelihood that the X-ray analyst will be able to determine any kind of symmetry in such complicated compounds in the present generation. In Astbury's recent investigation of tartaric acid the symmetry had, perforce, to be assumed.

The only other possibility that has occurred to me is that the arrangement of the internal electrons (as opposed to the chemical electrons) may affect crystal symmetry ; but as it is difficult to see how this could have any physico-chemical manifestation at the crystal surface, it has not been further examined.

In conclusion, it will be realised that the work on sal-ammoniac may represent a turning point in the history of the X-ray method, for no matter whether X-ray symmetry be held to be a pseudo-symmetry or a true symmetry, the practical consequences are the same. As emphasised by Wyckoff, the X-ray analyst must henceforth look upon crystal symmetry with suspicion, and not be led astray at the outset of his interpretation. Unfortunately, this leaves him in the air so far as symmetry is concerned, and implies a revision of many past models. The symmetry of calcite, for example, from the X-ray point of view is not necessarily the symmetry of Haüy. To the crystallographer it will remain so, until such time as new evidence shall demand a lower symmetry.

The following summary may be useful. Each crystal has a definite symmetry—that of a structure of a physico-chemical order of complexity. At the present time the only way to determine this symmetry is to study the surface or make use of a generalisation as the Pasteur principle, which has established itself on a permanent foundation. Any higher symmetries are pseudo-symmetries, and have their origin in a suppression of certain determinants. A notable example is X-ray symmetry, for it is compulsorily based on an atomic conception of crystal structure, and not on the molecular basis demanded by a wealth of chemical facts. An attempt is made to bridge the gulf between X-ray symmetry and crystal symmetry, but it is felt that the real solution is not yet in sight, owing mainly to the lack of a general chemical method of investigating crystal structure *in situ*.

T. V. BARKER.

University Museum, Oxford,
　　September 8.

Some Curious Numerical Relations.

IN the course of a series of computations it was noticed that the ratio of the numerical values of the following pairs of quantities is in each case an integral power of ten. This curious relation is so surprisingly exact that it seems worthy of record :

$$(h/2\pi)^2 = 1.08806 \times 10^{-54} \text{ erg}^2 \text{ sec.}^2$$
$$e^3/K_0 = 1.08804 \times 10^{-28} \text{ erg cm. es.}$$

$$e = 4.774 \times 10^{-10} \text{ es.}$$
$$h/k = 4.777 \times 10^{-11} \text{ sec. deg.}$$

$$m_0 = 8.9991 \times 10^{-28} \text{ gm.}$$
$$c^2 = 8.9916 \times 10^{20} \text{ cm.}^2 \text{ sec.}^{-2}$$

$$r_1 = 5.30507 \times 10^{-9} \text{ cm.}$$
$$e/m_0 = 5.30500 \times 10^{17} \text{ es. gm.}^{-1}$$

The symbol *es* has been used to denote the electrostatic unit of charge, r_1 the radius of the first Bohr ring in hydrogen, K_0 the dielectric constant of a vacuum, k the gas constant per molecule ; the other symbols have their usual significance. The values that served as the basis of the computation were those just given for e, e/m_0, and c, and the following: h, 6.554×10^{-27} erg sec. ; the faraday, 2.89365×10^{14} es. per equivalent ; the volume of one gram-molecule of ideal gas at $0°$ C. and one standard atmosphere, 22411.5 cm.³ per mole ; and $0°$ C., $273.1°$ K.

N. ERNEST DORSEY.

1410 H Street, N.W.,
　　Washington, D.C.

Lichens and their Action on the Glass and Leadings of Church Windows.

I HAVE read with great interest the paper by Dr. Ethel Mellor in NATURE of August 25 and I should like to refer to one or two points.

The paper gives the general impression that the decay of ancient stained glass is produced by the action of lichens. This has frequently been suggested, but surely the reverse is the case—the decay of the