

Avogadro's number² has been decreased by about 0.6 per cent from the value on which the X-unit was based. The new value is derived from the measurement of the density and unit cell of calcite³, the wave-length of the X-rays used being determined on an absolute scale by diffraction from a ruled grating. The error is equivalent to the statement that the X-unit differs from 10⁻³ Å. by 0.2 per cent. Therefore, if the new value of N_0 be accepted, one cannot use the Siegbahn scale of wave-lengths.

The formula for the number of molecules, n , in a unit cell is

$$n = \frac{N_0 \rho V}{M},$$

where ρ is the density, V is the volume of the cell, and M is the molecular weight. There are two ways of evaluating correctly n , M or ρ from this equation.

(1) The most recent value of N_0 , $6.0228 (\pm 0.0011) \times 10^{23}$ mole⁻¹, may be used, and V expressed in Å.³, that is, in absolute units. In order to derive the lattice constants the X-ray wave-lengths used must be corrected from the Siegbahn scale; some examples of the necessary changes are shown in the accompanying table.

	X-units	Ångström units	
Cu	$K\alpha_1$	1537.395	1.540522
	$K\alpha_2$	1541.232	1.544367
	$K\alpha$ (weighted mean)	1538.7	1.5418
	$K\beta_1$	1389.35	1.39218
Mo	$K\alpha_1$	707.831	0.709271
	$K\alpha_2$	712.105	0.713553
	$K\alpha$ (weighted mean)	709.26	0.71070
	$K\beta_1$	630.978	0.632261

(2) If one wishes to retain the Siegbahn scale, one must use an arbitrary value of N_0 , namely, 6.060×10^{23} mole⁻¹. In this case the lattice constants are in 1,000 X-units, although it is an invariable practice to call them Ångström units.

An error of the order of 0.6 per cent will occur if the new value of N_0 is used with the Siegbahn wave-lengths; this may be quite considerable if substances of high molecular weight are being studied.

The question arises as to which is the better of the two procedures. There is no doubt that the more logical is the former, in which case all wave-lengths need to be converted to Ångström units by multiplying the X-values by $1.00203_4 \times 10^{-3}$, the conversion factor given by Bearden⁴. There are two main objections to this. First, there may be some confusion during the change. Warren⁵ has suggested that this confusion would be lessened by using the symbol 'AA' to express 'absolute Ångström units'. Secondly, the conversion factor is still not known so accurately as are the relative wave-lengths, and so another adjustment may have to be made later. The relative wave-lengths are known probably to 0.001 per cent; and though Bearden is of the opinion that the conversion factor is also known to 0.001 per cent, Birge puts the error much higher, namely, 0.006 per cent. It might thus be thought preferable to wait until the conversion factor is known more accurately. It is possible, however, that no great improvement in accuracy can be expected with present techniques, in which case there would be no point in delay on this account.

Our own opinion, and that of the members of this Laboratory with whom we have discussed the matter, is that the new wave-lengths should be adopted; and it is hoped to get a more general opinion at the second X-Ray Conference of the Institute of Physics to be held in Cambridge in April. We should, how-

ever, be glad to know the opinions of others who may be interested in the question, and whose results may be affected by it.

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- ¹ Siegbahn, M., "The Spectroscopy of X-Rays" (London, 1925).
² Birge, R. T., "Reports of Progress in Physics", 8, 118 (1941).
³ DuMond, J. W. M., and Bollman, V. L., *Phys. Rev.*, 50, 524 (1936); 54, 1005 (1938).
⁴ Bearden, J. A., *J. App. Phys.*, 12, 395 (1941).
⁵ Warren, B. E., *J. App. Phys.*, 12, 375 (1941).

Penillic Acid, an Optically Active Acid from Penicillin

WE have observed that when highly active penicillin preparations are kept in aqueous solution at pH 2 there occurs a rise in the optical rotation which reaches a maximum and there remains constant. After this treatment only part of the material formerly readily extractable by ether can be removed by this solvent and there is left in the colourless aqueous phase a substance which is strongly dextro-rotatory and has a pale bluish fluorescence in ultra-violet light. This substance, which we have named *penillic acid*, can be extracted from the aqueous solution by butyl alcohol, from which it can be separated in crystalline condition. Penillic acid has been obtained in this way from barium penicillin preparation varying in activity from 300 units to 1,200 units per mgm., and as the yield is directly proportional to the biological activity of the penicillin used it seems not unlikely that penillic acid is derived from penicillin itself and not from its concomitants. The best yield so far obtained amounts to 20 per cent of the barium penicillin.

Penillic acid crystallizes from water in brilliant rhombs or in hexagonal plates which decompose at about 175° with evolution of gas but without charring. In aqueous solution ($c = 0.2$) it has the high specific rotation of +600° for the mercury green line. The solution of the recrystallized material shows the pale bluish fluorescence referred to above. It is acid to litmus and has some of the properties of an amino-acid. It gives a deep bluish-purple colour with ninhydrin and is precipitated by mercuric chloride and phosphotungstic acid. It forms a sparingly soluble silver salt. It readily decolourizes bromine water without formation of a precipitate. It does not give the blue colour with ferric chloride characteristic of penicillamine¹.

The penicillin used in these experiments was purified by the silica gel - barium carbonate column recently described by Catch, Cook and Heilbron² from penicillin kindly supplied by Dr. C. G. Pope, of the Wellcome Physiological Research Laboratories, to whom we make grateful acknowledgment.

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- ¹ Abraham, Chain, Baker, Robinson, *NATURE*, 151, 107 (1943).
² Catch, Cook, Heilbron, *NATURE*, 150, 633 (1942).