

Inequality in (6) suggests that for the series in (5) we must have

$$\xi \leq e^{-[0.0144 / (12D + 1)]^{1/4}} \quad (7)$$

Thus we see that, with the first 3 terms, the series in (5) gives θ to 4 decimal places over the range $1 < \xi < 1 + e^{[0.0144 / (12D + 1)]^{1/4}}$ for any value of D .

By the method of continuing the solutions, one may continue the solution toward the centre as well as toward the boundary. By increasing the number of terms in (4), one may also increase the range sufficiently³.

³ J. P. SHARMA is grateful to R. S. GUPTA, Department of Mathematics, Allahabad University for his helpful discussions and

Zusammenfassung. Weitere Untersuchungen über Lösungen der LANE-EMDEN-Gleichung in der Nähe des kritischen Punktes (vgl. *Experientia* 23, 697, 1967).

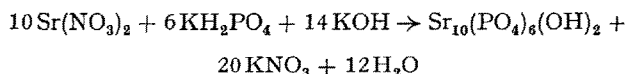
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Unit Cell Dimensions of Synthetic Apatites

The lattice parameters of some good synthetic apatites are reported here. The chlorapatite, fluorapatite, and mixed fluor-chlorapatites were kindly supplied by Dr. E. F. APPLE, General Electric Company, Cleveland, Ohio, and calcium hydroxyapatite by Dr. W. E. BROWN, National Bureau of Standards, Washington, D.C. The strontium hydroxyapatite was prepared by thoroughly mixing stoichiometric quantities of $\text{Sr}(\text{NO}_3)_2$, KH_2PO_4 , and KOH according to the equation:



The unit cell dimensions were obtained by 2 different methods: in one, the X-ray traces were a plot of 2θ along the chart drive direction versus intensity. The lowest 2θ value was on the right and was usually 5° . The maximum scale reading for intensity was indicated in cps. The little red lines above the chart were degree markers and were used for reading accurate angles. The 2θ angle was the angle between the incident X-ray beam and the diffracted beam. θ was the angle in Bragg's equation $\lambda = 2d_{hkl}\sin\theta$. $\text{CuK}\alpha$ radiation was used. In the other method, the X-ray powder photographs were taken on a CGR instrument in a Seeman-Bolhin focussing camera using $\text{CoK}\alpha$ radiation. The value 1.77892 \AA was taken for the wave-length of this radiation. The powdered apatite and small amounts of NaCl (in case of calcium apatites) and calcite (in case of strontium hydroxyapatite) used as internal standard were ground and spread over a mount of polystyrene foil.

From hydroxyapatite to chlorapatite, a increases but c decreases. In case of fluorapatite, a decreases but c

remains the same. Going on to mixed fluor-chlorapatites, a increases but c decreases. As the ionic radius of Sr^{+2} (1.13 \AA) is greater than Ca^{+2} (0.99 \AA), both a and c increase in case of strontium hydroxyapatite. The results are given in the Table.

The observed differences in lattice parameters are understandable from the various atomic positions in relation to the calcium triangle¹. The hydroxide ions² of hydroxyapatite lie with their internuclear axes coincident with the six-fold screw axis. The larger a axis of hydroxyapatite is due to Ca-O distance which requires a larger calcium triangle³. The chloride ions of chlorapatite lie on the six-fold screw axes but midway between adjacent planes¹. A model to explain the decrease in c and increase in a for chlorapatite has recently been presented³. The lattice difference between hydroxyapatite and fluorapatite is also brought about by change centered in the calcium triangle. Fluorine, being at the intersection of the planes with the six-fold screw axis, tends to contract the triangle until normal Ca-F distances are established³.

Résumé. Les paramètres cristallographiques d'un certain nombre d'apatites synthétiques sont indiqués. À l'aide d'études par rayons X ces apatites synthétiques peuvent être distingués les unes des autres.

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Unit cell dimensions of synthetic apatites

Apatite	a -axis A	c -axis A	c/a
$\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$	9.42	6.88	0.730
$\text{Ca}_{10}(\text{PO}_4)_6\text{Cl}_2$	9.63	6.78	0.704
$\text{Ca}_{10}(\text{PO}_4)_6\text{F}_2$	9.36	6.88	0.735
$\text{Ca}_{10}(\text{PO}_4)_6\text{F}_{0.554}\text{Cl}_{1.446}$	9.59	6.83	0.712
$\text{Ca}_{10}(\text{PO}_4)_6\text{F}_{1.449}\text{Cl}_{0.551}$	9.45	6.86	0.725
$\text{Sr}_{10}(\text{PO}_4)_6(\text{OH})_2$	9.76	7.28	0.745

¹ J. M. STUTMAN, J. D. TERMINE and A. S. POSNER, *Trans. N.Y. Acad. Sci.* 27, 669 (1965).

² International Union of Pure and Applied Chemistry, *Nomenclature of Inorganic Chemistry* (1957). OH^- should be called 'hydroxide ion'.

³ R. A. YOUNG and J. C. ELLIOTT, *Archs oral Biol.* 11, 699 (1966).

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