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Cyclohexaphosphates of Alkaline Metals

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CYCLOHEXAPHOSPHATES OF ALCALINE METALS

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The fast progress of chemistry of condensed phosphates resulted in a great attention to this kind of inorganic polymers all over the world. This paper reports preparation by ion exchange with lithium salt (1), solubility in water, some structural data and thermal transformation of alkaline metals cyclohexaphosphates (CHP). The crystal structures of all the compounds (table) were determined ($\text{Na}_6\text{P}_6\text{O}_{18} \cdot 6\text{H}_2\text{O}$ one has been described previously (2)). The crystals are built up of CHP-rings and alkaline metal (M^{I}) polyhedra, so that during the transition from Li to Cs coordination number (c.n.) of M^{I} increases from 4 to 9. In crystal $\text{Li}_6\text{P}_6\text{O}_{18} \cdot 5\text{H}_2\text{O}$ only 4 water molecules are coordinated by metal, moreover, there are channels where 2 additional water molecules may be placed. $\text{Rb}_6\text{P}_6\text{O}_{18} \cdot 6\text{H}_2\text{O}$ and $\text{Cs}_6\text{P}_6\text{O}_{18} \cdot 6\text{H}_2\text{O}$ were found to be isomorphous, as well as anhydrous $\text{K}_6\text{P}_6\text{O}_{18}$ and $\text{Rb}_6\text{P}_6\text{O}_{18}$.

TABLE
X-ray crystallographic CHP data

Compound	Sp.gr	a, Å	b, Å	c, Å	α, gr	β, gr	γ, gr	c.n.
$\text{Li}_6\text{P}_6\text{O}_{18} \cdot 5\text{H}_2\text{O}$	$\text{P}\bar{1}$	9,490	8,069	7,810	107,2	113,8	65,19	4
$\text{Na}_6\text{P}_6\text{O}_{18} \cdot 6\text{H}_2\text{O}$	Ccmm	11,58	18,54	10,48				6
$\text{K}_6\text{P}_6\text{O}_{18}$	Pa3	15,74						6
$\text{K}_6\text{P}_6\text{O}_{18} \cdot 3\text{H}_2\text{O}$	$\text{P}2_1/\text{m}$	6,803	17,45	9,195		107,2		7,8
$\text{Rb}_6\text{P}_6\text{O}_{18} \cdot 6\text{H}_2\text{O}$	$\text{P}\bar{1}$	9,626	9,623	8,698	111,1	107,9	60,24	9
$\text{Cs}_6\text{P}_6\text{O}_{18} \cdot 6\text{H}_2\text{O}$	$\text{P}\bar{1}$	9,881	9,890	9,006	111,5	106,6	60,07	9
$\text{Rb}_6\text{P}_6\text{O}_{18}$	-	16,23						(?)
$\text{Cs}_6\text{P}_6\text{O}_{18}$	-	25,16						(?)

(1) U.Schülke, R.Kayzer, Z.Anorg.Allg.Chem. 531, 167 (1985).

(2) K.-H.Jost, Acta Cryst. 19, 555 (1965).