α-$LiZnPO_4$ Structure: AB4CD_mC224_9_8a_32a_8a_8a-001

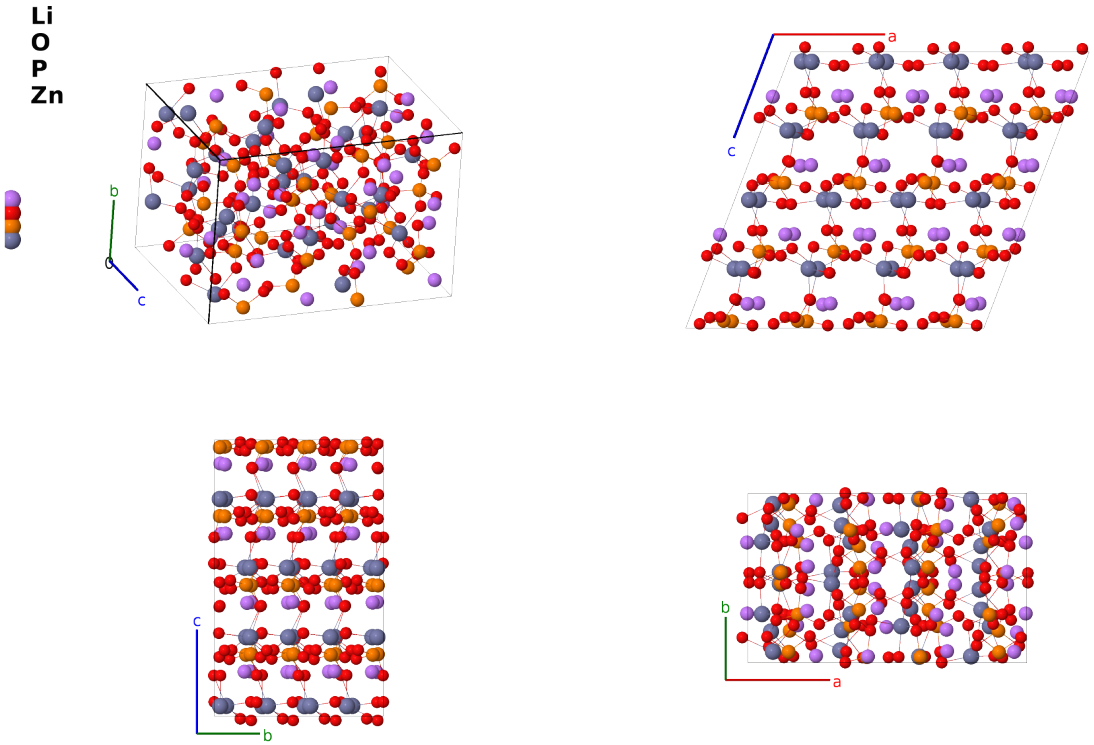
Cite this page as:

- H. Eckert, S. Divilov, M. J. Mehl, D. Hicks, A. C. Zettel, M. Esters, X. Campilongo, and S. Curtarolo, *The AFLOW Library of Crystallographic Prototypes: Part 4*, Comput. Mater. Sci. **240**, 112988 (2024), doi: 10.1016/j.commatsci.2024.112988.
- D. Hicks, M. J. Mehl, M. Esters, C. Oses, O. Levy, G. L. W. Hart, C. Toher, and S. Curtarolo, *The AFLOW Library of Crystallographic Prototypes: Part 3*, Comput. Mater. Sci. **199**, 110450 (2021), doi: 10.1016/j.commatsci.2021.110450.

---

https://aflow.org/prototype-encyclopedia/L704

https://aflow.org/prototype-encyclopedia/AB4CD_mC224_9_8a_32a_8a_8a-001



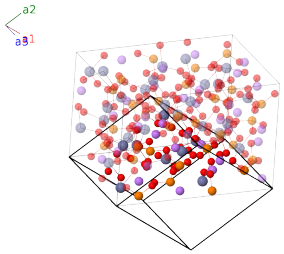
Prototype	LiO_4PZn
AFLOW prototype label	AB4CD_mC224_9_8a_32a_8a_8a-001
ICSD	65764
CCDC	1627878
Pearson symbol	mC224
Space group number	9
Space group symbol	Cc
AFLOW prototype command	`aflow --proto=AB4CD_mC224_9_8a_32a_8a_8a-001 --params=`$a, b/a, c/a, \beta, x_1, y_1, z_1, x_2, y_2, z_2, x_3, y_3, z_3, x_4, y_4, z_4, x_5, y_5, z_5, x_6, y_6, z_6, x_7, y_7, z_7, x_8, y_8, z_8, x_9, y_9, z_9, x_{10}, y_{10}, z_{10}, x_{11}, y_{11}, z_{11}, x_{12}, y_{12}, z_{12}, x_{13}, y_{13}, z_{13}, x_{14}, y_{14}, z_{14}, x_{15}, y_{15}, z_{15}, x_{16}, y_{16}, z_{16}, x_{17}, y_{17}, z_{17}, x_{18}, y_{18}, z_{18}, x_{19}, y_{19}, z_{19}, x_{20}, y_{20}, z_{20}, x_{21}, y_{21}, z_{21}, x_{22}, y_{22}, z_{22}, x_{23}, y_{23}, z_{23}, x_{24}, y_{24}, z_{24}, x_{25}, y_{25}, z_{25}, x_{26}, y_{26}, z_{26}, x_{27}, y_{27}, z_{27}, x_{28}, y_{28}, z_{28}, x_{29}, y_{29}, z_{29},$

$x_{30}, y_{30}, z_{30}, x_{31}, y_{31}, z_{31}, x_{32}, y_{32}, z_{32}, x_{33}, y_{33}, z_{33}, x_{34}, y_{34}, z_{34}, x_{35}, y_{35}, z_{35}, x_{36}, y_{36}, z_{36}, x_{37}, y_{37}, z_{37}, x_{38}, y_{38}, z_{38}, x_{39}, y_{39}, z_{39}, x_{40}, y_{40}, z_{40}, x_{41}, y_{41}, z_{41}, x_{42}, y_{42}, z_{42}, x_{43}, y_{43}, z_{43}, x_{44}, y_{44}, z_{44}, x_{45}, y_{45}, z_{45}, x_{46}, y_{46}, z_{46}, x_{47}, y_{47}, z_{47}, x_{48}, y_{48}, z_{48}, x_{49}, y_{49}, z_{49}, x_{50}, y_{50}, z_{50}, x_{51}, y_{51}, z_{51}, x_{52}, y_{52}, z_{52}, x_{53}, y_{53}, z_{53}, x_{54}, y_{54}, z_{54}, x_{55}, y_{55}, z_{55}, x_{56}, y_{56}, z_{56}$

- $LiZnPO_4$ has been observed in a variety of structures. We list those which have know crystal structures:
  - α-$LiZnPO_4$ (this structure)
  - δ_1-$LiZnPO_4$, and
  - rhombohedral $LiZnPO_4$.

Base-centered Monoclinic primitive vectors

$$
\begin{aligned}
\mathbf{a_1} &= \frac{1}{2}a\,\hat{\mathbf{x}} - \frac{1}{2}b\,\hat{\mathbf{y}} \\
\mathbf{a_2} &= \frac{1}{2}a\,\hat{\mathbf{x}} + \frac{1}{2}b\,\hat{\mathbf{y}} \\
\mathbf{a_3} &= c\cos\beta\,\hat{\mathbf{x}} + c\sin\beta\,\hat{\mathbf{z}}
\end{aligned}
$$



Basis vectors

		Lattice coordinates		Cartesian coordinates	Wyckoff position	Atom type
$\mathbf{B_1}$	=	$(x_1 - y_1)\,\mathbf{a}_1 + (x_1 + y_1)\,\mathbf{a}_2 + z_1\,\mathbf{a}_3$	=	$(ax_1 + cz_1\cos\beta)\,\hat{\mathbf{x}} + by_1\,\hat{\mathbf{y}} + cz_1\sin\beta\,\hat{\mathbf{z}}$	(4a)	Li I
$\mathbf{B_2}$	=	$(x_1 + y_1)\,\mathbf{a}_1 + (x_1 - y_1)\,\mathbf{a}_2 + \left(z_1 + \frac{1}{2}\right)\,\mathbf{a}_3$	=	$\left(ax_1 + c\left(z_1 + \frac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_1\,\hat{\mathbf{y}} + c\left(z_1 + \frac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}}$	(4a)	Li I
$\mathbf{B_3}$	=	$(x_2 - y_2)\,\mathbf{a}_1 + (x_2 + y_2)\,\mathbf{a}_2 + z_2\,\mathbf{a}_3$	=	$(ax_2 + cz_2\cos\beta)\,\hat{\mathbf{x}} + by_2\,\hat{\mathbf{y}} + cz_2\sin\beta\,\hat{\mathbf{z}}$	(4a)	Li II
$\mathbf{B_4}$	=	$(x_2 + y_2)\,\mathbf{a}_1 + (x_2 - y_2)\,\mathbf{a}_2 + \left(z_2 + \frac{1}{2}\right)\,\mathbf{a}_3$	=	$\left(ax_2 + c\left(z_2 + \frac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_2\,\hat{\mathbf{y}} + c\left(z_2 + \frac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}}$	(4a)	Li II
$\mathbf{B_5}$	=	$(x_3 - y_3)\,\mathbf{a}_1 + (x_3 + y_3)\,\mathbf{a}_2 + z_3\,\mathbf{a}_3$	=	$(ax_3 + cz_3\cos\beta)\,\hat{\mathbf{x}} + by_3\,\hat{\mathbf{y}} + cz_3\sin\beta\,\hat{\mathbf{z}}$	(4a)	Li III
$\mathbf{B_6}$	=	$(x_3 + y_3)\,\mathbf{a}_1 + (x_3 - y_3)\,\mathbf{a}_2 + \left(z_3 + \frac{1}{2}\right)\,\mathbf{a}_3$	=	$\left(ax_3 + c\left(z_3 + \frac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_3\,\hat{\mathbf{y}} + c\left(z_3 + \frac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}}$	(4a)	Li III
$\mathbf{B_7}$	=	$(x_4 - y_4)\,\mathbf{a}_1 + (x_4 + y_4)\,\mathbf{a}_2 + z_4\,\mathbf{a}_3$	=	$(ax_4 + cz_4\cos\beta)\,\hat{\mathbf{x}} + by_4\,\hat{\mathbf{y}} + cz_4\sin\beta\,\hat{\mathbf{z}}$	(4a)	Li IV
$\mathbf{B_8}$	=	$(x_4 + y_4)\,\mathbf{a}_1 + (x_4 - y_4)\,\mathbf{a}_2 + \left(z_4 + \frac{1}{2}\right)\,\mathbf{a}_3$	=	$\left(ax_4 + c\left(z_4 + \frac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_4\,\hat{\mathbf{y}} + c\left(z_4 + \frac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}}$	(4a)	Li IV
$\mathbf{B_9}$	=	$(x_5 - y_5)\,\mathbf{a}_1 + (x_5 + y_5)\,\mathbf{a}_2 + z_5\,\mathbf{a}_3$	=	$(ax_5 + cz_5\cos\beta)\,\hat{\mathbf{x}} + by_5\,\hat{\mathbf{y}} + cz_5\sin\beta\,\hat{\mathbf{z}}$	(4a)	Li V
$\mathbf{B_{10}}$	=	$(x_5 + y_5)\,\mathbf{a}_1 + (x_5 - y_5)\,\mathbf{a}_2 + \left(z_5 + \frac{1}{2}\right)\,\mathbf{a}_3$	=	$\left(ax_5 + c\left(z_5 + \frac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_5\,\hat{\mathbf{y}} + c\left(z_5 + \frac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}}$	(4a)	Li V
$\mathbf{B_{11}}$	=	$(x_6 - y_6)\,\mathbf{a}_1 + (x_6 + y_6)\,\mathbf{a}_2 + z_6\,\mathbf{a}_3$	=	$(ax_6 + cz_6\cos\beta)\,\hat{\mathbf{x}} + by_6\,\hat{\mathbf{y}} + cz_6\sin\beta\,\hat{\mathbf{z}}$	(4a)	Li VI
$\mathbf{B_{12}}$	=	$(x_6 + y_6)\,\mathbf{a}_1 + (x_6 - y_6)\,\mathbf{a}_2 + \left(z_6 + \frac{1}{2}\right)\,\mathbf{a}_3$	=	$\left(ax_6 + c\left(z_6 + \frac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_6\,\hat{\mathbf{y}} + c\left(z_6 + \frac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}}$	(4a)	Li VI

$\mathbf{B_{13}}$	=	$(x_7 - y_7)\ \mathbf{a}_1 + (x_7 + y_7)\ \mathbf{a}_2 + z_7\ \mathbf{a}_3$	=	$(ax_7 + cz_7 \cos\beta)\ \hat{\mathbf{x}} + by_7\ \hat{\mathbf{y}} + cz_7 \sin\beta\ \hat{\mathbf{z}}$	(4a)	Li VII
$\mathbf{B_{14}}$	=	$(x_7 + y_7)\ \mathbf{a}_1 + (x_7 - y_7)\ \mathbf{a}_2 + \left(z_7 + \frac{1}{2}\right)\ \mathbf{a}_3$	=	$\left(ax_7 + c\left(z_7 + \frac{1}{2}\right)\cos\beta\right)\ \hat{\mathbf{x}} - by_7\ \hat{\mathbf{y}} + c\left(z_7 + \frac{1}{2}\right)\sin\beta\ \hat{\mathbf{z}}$	(4a)	Li VII
$\mathbf{B_{15}}$	=	$(x_8 - y_8)\ \mathbf{a}_1 + (x_8 + y_8)\ \mathbf{a}_2 + z_8\ \mathbf{a}_3$	=	$(ax_8 + cz_8 \cos\beta)\ \hat{\mathbf{x}} + by_8\ \hat{\mathbf{y}} + cz_8 \sin\beta\ \hat{\mathbf{z}}$	(4a)	Li VIII
$\mathbf{B_{16}}$	=	$(x_8 + y_8)\ \mathbf{a}_1 + (x_8 - y_8)\ \mathbf{a}_2 + \left(z_8 + \frac{1}{2}\right)\ \mathbf{a}_3$	=	$\left(ax_8 + c\left(z_8 + \frac{1}{2}\right)\cos\beta\right)\ \hat{\mathbf{x}} - by_8\ \hat{\mathbf{y}} + c\left(z_8 + \frac{1}{2}\right)\sin\beta\ \hat{\mathbf{z}}$	(4a)	Li VIII
$\mathbf{B_{17}}$	=	$(x_9 - y_9)\ \mathbf{a}_1 + (x_9 + y_9)\ \mathbf{a}_2 + z_9\ \mathbf{a}_3$	=	$(ax_9 + cz_9 \cos\beta)\ \hat{\mathbf{x}} + by_9\ \hat{\mathbf{y}} + cz_9 \sin\beta\ \hat{\mathbf{z}}$	(4a)	O I
$\mathbf{B_{18}}$	=	$(x_9 + y_9)\ \mathbf{a}_1 + (x_9 - y_9)\ \mathbf{a}_2 + \left(z_9 + \frac{1}{2}\right)\ \mathbf{a}_3$	=	$\left(ax_9 + c\left(z_9 + \frac{1}{2}\right)\cos\beta\right)\ \hat{\mathbf{x}} - by_9\ \hat{\mathbf{y}} + c\left(z_9 + \frac{1}{2}\right)\sin\beta\ \hat{\mathbf{z}}$	(4a)	O I
$\mathbf{B_{19}}$	=	$(x_{10} - y_{10})\ \mathbf{a}_1 + (x_{10} + y_{10})\ \mathbf{a}_2 + z_{10}\ \mathbf{a}_3$	=	$(ax_{10} + cz_{10} \cos\beta)\ \hat{\mathbf{x}} + by_{10}\ \hat{\mathbf{y}} + cz_{10} \sin\beta\ \hat{\mathbf{z}}$	(4a)	O II
$\mathbf{B_{20}}$	=	$(x_{10} + y_{10})\ \mathbf{a}_1 + (x_{10} - y_{10})\ \mathbf{a}_2 + \left(z_{10} + \frac{1}{2}\right)\ \mathbf{a}_3$	=	$\left(ax_{10} + c\left(z_{10} + \frac{1}{2}\right)\cos\beta\right)\ \hat{\mathbf{x}} - by_{10}\ \hat{\mathbf{y}} + c\left(z_{10} + \frac{1}{2}\right)\sin\beta\ \hat{\mathbf{z}}$	(4a)	O II
$\mathbf{B_{21}}$	=	$(x_{11} - y_{11})\ \mathbf{a}_1 + (x_{11} + y_{11})\ \mathbf{a}_2 + z_{11}\ \mathbf{a}_3$	=	$(ax_{11} + cz_{11} \cos\beta)\ \hat{\mathbf{x}} + by_{11}\ \hat{\mathbf{y}} + cz_{11} \sin\beta\ \hat{\mathbf{z}}$	(4a)	O III
$\mathbf{B_{22}}$	=	$(x_{11} + y_{11})\ \mathbf{a}_1 + (x_{11} - y_{11})\ \mathbf{a}_2 + \left(z_{11} + \frac{1}{2}\right)\ \mathbf{a}_3$	=	$\left(ax_{11} + c\left(z_{11} + \frac{1}{2}\right)\cos\beta\right)\ \hat{\mathbf{x}} - by_{11}\ \hat{\mathbf{y}} + c\left(z_{11} + \frac{1}{2}\right)\sin\beta\ \hat{\mathbf{z}}$	(4a)	O III
$\mathbf{B_{23}}$	=	$(x_{12} - y_{12})\ \mathbf{a}_1 + (x_{12} + y_{12})\ \mathbf{a}_2 + z_{12}\ \mathbf{a}_3$	=	$(ax_{12} + cz_{12} \cos\beta)\ \hat{\mathbf{x}} + by_{12}\ \hat{\mathbf{y}} + cz_{12} \sin\beta\ \hat{\mathbf{z}}$	(4a)	O IV
$\mathbf{B_{24}}$	=	$(x_{12} + y_{12})\ \mathbf{a}_1 + (x_{12} - y_{12})\ \mathbf{a}_2 + \left(z_{12} + \frac{1}{2}\right)\ \mathbf{a}_3$	=	$\left(ax_{12} + c\left(z_{12} + \frac{1}{2}\right)\cos\beta\right)\ \hat{\mathbf{x}} - by_{12}\ \hat{\mathbf{y}} + c\left(z_{12} + \frac{1}{2}\right)\sin\beta\ \hat{\mathbf{z}}$	(4a)	O IV
$\mathbf{B_{25}}$	=	$(x_{13} - y_{13})\ \mathbf{a}_1 + (x_{13} + y_{13})\ \mathbf{a}_2 + z_{13}\ \mathbf{a}_3$	=	$(ax_{13} + cz_{13} \cos\beta)\ \hat{\mathbf{x}} + by_{13}\ \hat{\mathbf{y}} + cz_{13} \sin\beta\ \hat{\mathbf{z}}$	(4a)	O V
$\mathbf{B_{26}}$	=	$(x_{13} + y_{13})\ \mathbf{a}_1 + (x_{13} - y_{13})\ \mathbf{a}_2 + \left(z_{13} + \frac{1}{2}\right)\ \mathbf{a}_3$	=	$\left(ax_{13} + c\left(z_{13} + \frac{1}{2}\right)\cos\beta\right)\ \hat{\mathbf{x}} - by_{13}\ \hat{\mathbf{y}} + c\left(z_{13} + \frac{1}{2}\right)\sin\beta\ \hat{\mathbf{z}}$	(4a)	O V
$\mathbf{B_{27}}$	=	$(x_{14} - y_{14})\ \mathbf{a}_1 + (x_{14} + y_{14})\ \mathbf{a}_2 + z_{14}\ \mathbf{a}_3$	=	$(ax_{14} + cz_{14} \cos\beta)\ \hat{\mathbf{x}} + by_{14}\ \hat{\mathbf{y}} + cz_{14} \sin\beta\ \hat{\mathbf{z}}$	(4a)	O VI
$\mathbf{B_{28}}$	=	$(x_{14} + y_{14})\ \mathbf{a}_1 + (x_{14} - y_{14})\ \mathbf{a}_2 + \left(z_{14} + \frac{1}{2}\right)\ \mathbf{a}_3$	=	$\left(ax_{14} + c\left(z_{14} + \frac{1}{2}\right)\cos\beta\right)\ \hat{\mathbf{x}} - by_{14}\ \hat{\mathbf{y}} + c\left(z_{14} + \frac{1}{2}\right)\sin\beta\ \hat{\mathbf{z}}$	(4a)	O VI
$\mathbf{B_{29}}$	=	$(x_{15} - y_{15})\ \mathbf{a}_1 + (x_{15} + y_{15})\ \mathbf{a}_2 + z_{15}\ \mathbf{a}_3$	=	$(ax_{15} + cz_{15} \cos\beta)\ \hat{\mathbf{x}} + by_{15}\ \hat{\mathbf{y}} + cz_{15} \sin\beta\ \hat{\mathbf{z}}$	(4a)	O VII
$\mathbf{B_{30}}$	=	$(x_{15} + y_{15})\ \mathbf{a}_1 + (x_{15} - y_{15})\ \mathbf{a}_2 + \left(z_{15} + \frac{1}{2}\right)\ \mathbf{a}_3$	=	$\left(ax_{15} + c\left(z_{15} + \frac{1}{2}\right)\cos\beta\right)\ \hat{\mathbf{x}} - by_{15}\ \hat{\mathbf{y}} + c\left(z_{15} + \frac{1}{2}\right)\sin\beta\ \hat{\mathbf{z}}$	(4a)	O VII
$\mathbf{B_{31}}$	=	$(x_{16} - y_{16})\ \mathbf{a}_1 + (x_{16} + y_{16})\ \mathbf{a}_2 + z_{16}\ \mathbf{a}_3$	=	$(ax_{16} + cz_{16} \cos\beta)\ \hat{\mathbf{x}} + by_{16}\ \hat{\mathbf{y}} + cz_{16} \sin\beta\ \hat{\mathbf{z}}$	(4a)	O VIII
$\mathbf{B_{32}}$	=	$(x_{16} + y_{16})\ \mathbf{a}_1 + (x_{16} - y_{16})\ \mathbf{a}_2 + \left(z_{16} + \frac{1}{2}\right)\ \mathbf{a}_3$	=	$\left(ax_{16} + c\left(z_{16} + \frac{1}{2}\right)\cos\beta\right)\ \hat{\mathbf{x}} - by_{16}\ \hat{\mathbf{y}} + c\left(z_{16} + \frac{1}{2}\right)\sin\beta\ \hat{\mathbf{z}}$	(4a)	O VIII
$\mathbf{B_{33}}$	=	$(x_{17} - y_{17})\ \mathbf{a}_1 + (x_{17} + y_{17})\ \mathbf{a}_2 + z_{17}\ \mathbf{a}_3$	=	$(ax_{17} + cz_{17} \cos\beta)\ \hat{\mathbf{x}} + by_{17}\ \hat{\mathbf{y}} + cz_{17} \sin\beta\ \hat{\mathbf{z}}$	(4a)	O IX
$\mathbf{B_{34}}$	=	$(x_{17} + y_{17})\ \mathbf{a}_1 + (x_{17} - y_{17})\ \mathbf{a}_2 + \left(z_{17} + \frac{1}{2}\right)\ \mathbf{a}_3$	=	$\left(ax_{17} + c\left(z_{17} + \frac{1}{2}\right)\cos\beta\right)\ \hat{\mathbf{x}} - by_{17}\ \hat{\mathbf{y}} + c\left(z_{17} + \frac{1}{2}\right)\sin\beta\ \hat{\mathbf{z}}$	(4a)	O IX
$\mathbf{B_{35}}$	=	$(x_{18} - y_{18})\ \mathbf{a}_1 + (x_{18} + y_{18})\ \mathbf{a}_2 + z_{18}\ \mathbf{a}_3$	=	$(ax_{18} + cz_{18} \cos\beta)\ \hat{\mathbf{x}} + by_{18}\ \hat{\mathbf{y}} + cz_{18} \sin\beta\ \hat{\mathbf{z}}$	(4a)	O X

$$\mathbf{B_{36}} = (x_{18}+y_{18})\,\mathbf{a}_1 + (x_{18}-y_{18})\,\mathbf{a}_2 + \left(z_{18}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{18} + c\left(z_{18}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{18}\,\hat{\mathbf{y}} + c\left(z_{18}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O X}$$

$$\mathbf{B_{37}} = (x_{19}-y_{19})\,\mathbf{a}_1 + (x_{19}+y_{19})\,\mathbf{a}_2 + z_{19}\,\mathbf{a}_3 = (ax_{19} + cz_{19}\cos\beta)\,\hat{\mathbf{x}} + by_{19}\,\hat{\mathbf{y}} + cz_{19}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XI}$$

$$\mathbf{B_{38}} = (x_{19}+y_{19})\,\mathbf{a}_1 + (x_{19}-y_{19})\,\mathbf{a}_2 + \left(z_{19}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{19} + c\left(z_{19}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{19}\,\hat{\mathbf{y}} + c\left(z_{19}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XI}$$

$$\mathbf{B_{39}} = (x_{20}-y_{20})\,\mathbf{a}_1 + (x_{20}+y_{20})\,\mathbf{a}_2 + z_{20}\,\mathbf{a}_3 = (ax_{20} + cz_{20}\cos\beta)\,\hat{\mathbf{x}} + by_{20}\,\hat{\mathbf{y}} + cz_{20}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XII}$$

$$\mathbf{B_{40}} = (x_{20}+y_{20})\,\mathbf{a}_1 + (x_{20}-y_{20})\,\mathbf{a}_2 + \left(z_{20}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{20} + c\left(z_{20}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{20}\,\hat{\mathbf{y}} + c\left(z_{20}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XII}$$

$$\mathbf{B_{41}} = (x_{21}-y_{21})\,\mathbf{a}_1 + (x_{21}+y_{21})\,\mathbf{a}_2 + z_{21}\,\mathbf{a}_3 = (ax_{21} + cz_{21}\cos\beta)\,\hat{\mathbf{x}} + by_{21}\,\hat{\mathbf{y}} + cz_{21}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XIII}$$

$$\mathbf{B_{42}} = (x_{21}+y_{21})\,\mathbf{a}_1 + (x_{21}-y_{21})\,\mathbf{a}_2 + \left(z_{21}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{21} + c\left(z_{21}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{21}\,\hat{\mathbf{y}} + c\left(z_{21}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XIII}$$

$$\mathbf{B_{43}} = (x_{22}-y_{22})\,\mathbf{a}_1 + (x_{22}+y_{22})\,\mathbf{a}_2 + z_{22}\,\mathbf{a}_3 = (ax_{22} + cz_{22}\cos\beta)\,\hat{\mathbf{x}} + by_{22}\,\hat{\mathbf{y}} + cz_{22}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XIV}$$

$$\mathbf{B_{44}} = (x_{22}+y_{22})\,\mathbf{a}_1 + (x_{22}-y_{22})\,\mathbf{a}_2 + \left(z_{22}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{22} + c\left(z_{22}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{22}\,\hat{\mathbf{y}} + c\left(z_{22}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XIV}$$

$$\mathbf{B_{45}} = (x_{23}-y_{23})\,\mathbf{a}_1 + (x_{23}+y_{23})\,\mathbf{a}_2 + z_{23}\,\mathbf{a}_3 = (ax_{23} + cz_{23}\cos\beta)\,\hat{\mathbf{x}} + by_{23}\,\hat{\mathbf{y}} + cz_{23}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XV}$$

$$\mathbf{B_{46}} = (x_{23}+y_{23})\,\mathbf{a}_1 + (x_{23}-y_{23})\,\mathbf{a}_2 + \left(z_{23}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{23} + c\left(z_{23}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{23}\,\hat{\mathbf{y}} + c\left(z_{23}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XV}$$

$$\mathbf{B_{47}} = (x_{24}-y_{24})\,\mathbf{a}_1 + (x_{24}+y_{24})\,\mathbf{a}_2 + z_{24}\,\mathbf{a}_3 = (ax_{24} + cz_{24}\cos\beta)\,\hat{\mathbf{x}} + by_{24}\,\hat{\mathbf{y}} + cz_{24}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XVI}$$

$$\mathbf{B_{48}} = (x_{24}+y_{24})\,\mathbf{a}_1 + (x_{24}-y_{24})\,\mathbf{a}_2 + \left(z_{24}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{24} + c\left(z_{24}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{24}\,\hat{\mathbf{y}} + c\left(z_{24}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XVI}$$

$$\mathbf{B_{49}} = (x_{25}-y_{25})\,\mathbf{a}_1 + (x_{25}+y_{25})\,\mathbf{a}_2 + z_{25}\,\mathbf{a}_3 = (ax_{25} + cz_{25}\cos\beta)\,\hat{\mathbf{x}} + by_{25}\,\hat{\mathbf{y}} + cz_{25}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XVII}$$

$$\mathbf{B_{50}} = (x_{25}+y_{25})\,\mathbf{a}_1 + (x_{25}-y_{25})\,\mathbf{a}_2 + \left(z_{25}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{25} + c\left(z_{25}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{25}\,\hat{\mathbf{y}} + c\left(z_{25}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XVII}$$

$$\mathbf{B_{51}} = (x_{26}-y_{26})\,\mathbf{a}_1 + (x_{26}+y_{26})\,\mathbf{a}_2 + z_{26}\,\mathbf{a}_3 = (ax_{26} + cz_{26}\cos\beta)\,\hat{\mathbf{x}} + by_{26}\,\hat{\mathbf{y}} + cz_{26}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XVIII}$$

$$\mathbf{B_{52}} = (x_{26}+y_{26})\,\mathbf{a}_1 + (x_{26}-y_{26})\,\mathbf{a}_2 + \left(z_{26}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{26} + c\left(z_{26}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{26}\,\hat{\mathbf{y}} + c\left(z_{26}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XVIII}$$

$$\mathbf{B_{53}} = (x_{27}-y_{27})\,\mathbf{a}_1 + (x_{27}+y_{27})\,\mathbf{a}_2 + z_{27}\,\mathbf{a}_3 = (ax_{27} + cz_{27}\cos\beta)\,\hat{\mathbf{x}} + by_{27}\,\hat{\mathbf{y}} + cz_{27}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XIX}$$

$$\mathbf{B_{54}} = (x_{27}+y_{27})\,\mathbf{a}_1 + (x_{27}-y_{27})\,\mathbf{a}_2 + \left(z_{27}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{27} + c\left(z_{27}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{27}\,\hat{\mathbf{y}} + c\left(z_{27}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XIX}$$

$$\mathbf{B_{55}} = (x_{28}-y_{28})\,\mathbf{a}_1 + (x_{28}+y_{28})\,\mathbf{a}_2 + z_{28}\,\mathbf{a}_3 = (ax_{28} + cz_{28}\cos\beta)\,\hat{\mathbf{x}} + by_{28}\,\hat{\mathbf{y}} + cz_{28}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XX}$$

$$\mathbf{B_{56}} = (x_{28}+y_{28})\,\mathbf{a}_1 + (x_{28}-y_{28})\,\mathbf{a}_2 + \left(z_{28}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{28} + c\left(z_{28}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{28}\,\hat{\mathbf{y}} + c\left(z_{28}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XX}$$

$$\mathbf{B_{57}} = (x_{29}-y_{29})\,\mathbf{a}_1 + (x_{29}+y_{29})\,\mathbf{a}_2 + z_{29}\,\mathbf{a}_3 = (ax_{29} + cz_{29}\cos\beta)\,\hat{\mathbf{x}} + by_{29}\,\hat{\mathbf{y}} + cz_{29}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXI}$$

$$\mathbf{B_{58}} = (x_{29}+y_{29})\,\mathbf{a}_1 + (x_{29}-y_{29})\,\mathbf{a}_2 + \left(z_{29}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{29} + c\left(z_{29}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{29}\,\hat{\mathbf{y}} + c\left(z_{29}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXI}$$

$$\mathbf{B_{59}} = (x_{30} - y_{30})\,\mathbf{a}_1 + (x_{30} + y_{30})\,\mathbf{a}_2 + z_{30}\,\mathbf{a}_3 = (ax_{30} + cz_{30}\cos\beta)\,\hat{\mathbf{x}} + by_{30}\,\hat{\mathbf{y}} + cz_{30}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXII}$$

$$\mathbf{B_{60}} = (x_{30} + y_{30})\,\mathbf{a}_1 + (x_{30} - y_{30})\,\mathbf{a}_2 + \left(z_{30} + \tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{30} + c\left(z_{30} + \tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{30}\,\hat{\mathbf{y}} + c\left(z_{30} + \tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXII}$$

$$\mathbf{B_{61}} = (x_{31} - y_{31})\,\mathbf{a}_1 + (x_{31} + y_{31})\,\mathbf{a}_2 + z_{31}\,\mathbf{a}_3 = (ax_{31} + cz_{31}\cos\beta)\,\hat{\mathbf{x}} + by_{31}\,\hat{\mathbf{y}} + cz_{31}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXIII}$$

$$\mathbf{B_{62}} = (x_{31} + y_{31})\,\mathbf{a}_1 + (x_{31} - y_{31})\,\mathbf{a}_2 + \left(z_{31} + \tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{31} + c\left(z_{31} + \tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{31}\,\hat{\mathbf{y}} + c\left(z_{31} + \tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXIII}$$

$$\mathbf{B_{63}} = (x_{32} - y_{32})\,\mathbf{a}_1 + (x_{32} + y_{32})\,\mathbf{a}_2 + z_{32}\,\mathbf{a}_3 = (ax_{32} + cz_{32}\cos\beta)\,\hat{\mathbf{x}} + by_{32}\,\hat{\mathbf{y}} + cz_{32}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXIV}$$

$$\mathbf{B_{64}} = (x_{32} + y_{32})\,\mathbf{a}_1 + (x_{32} - y_{32})\,\mathbf{a}_2 + \left(z_{32} + \tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{32} + c\left(z_{32} + \tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{32}\,\hat{\mathbf{y}} + c\left(z_{32} + \tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXIV}$$

$$\mathbf{B_{65}} = (x_{33} - y_{33})\,\mathbf{a}_1 + (x_{33} + y_{33})\,\mathbf{a}_2 + z_{33}\,\mathbf{a}_3 = (ax_{33} + cz_{33}\cos\beta)\,\hat{\mathbf{x}} + by_{33}\,\hat{\mathbf{y}} + cz_{33}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXV}$$

$$\mathbf{B_{66}} = (x_{33} + y_{33})\,\mathbf{a}_1 + (x_{33} - y_{33})\,\mathbf{a}_2 + \left(z_{33} + \tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{33} + c\left(z_{33} + \tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{33}\,\hat{\mathbf{y}} + c\left(z_{33} + \tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXV}$$

$$\mathbf{B_{67}} = (x_{34} - y_{34})\,\mathbf{a}_1 + (x_{34} + y_{34})\,\mathbf{a}_2 + z_{34}\,\mathbf{a}_3 = (ax_{34} + cz_{34}\cos\beta)\,\hat{\mathbf{x}} + by_{34}\,\hat{\mathbf{y}} + cz_{34}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXVI}$$

$$\mathbf{B_{68}} = (x_{34} + y_{34})\,\mathbf{a}_1 + (x_{34} - y_{34})\,\mathbf{a}_2 + \left(z_{34} + \tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{34} + c\left(z_{34} + \tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{34}\,\hat{\mathbf{y}} + c\left(z_{34} + \tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXVI}$$

$$\mathbf{B_{69}} = (x_{35} - y_{35})\,\mathbf{a}_1 + (x_{35} + y_{35})\,\mathbf{a}_2 + z_{35}\,\mathbf{a}_3 = (ax_{35} + cz_{35}\cos\beta)\,\hat{\mathbf{x}} + by_{35}\,\hat{\mathbf{y}} + cz_{35}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXVII}$$

$$\mathbf{B_{70}} = (x_{35} + y_{35})\,\mathbf{a}_1 + (x_{35} - y_{35})\,\mathbf{a}_2 + \left(z_{35} + \tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{35} + c\left(z_{35} + \tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{35}\,\hat{\mathbf{y}} + c\left(z_{35} + \tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXVII}$$

$$\mathbf{B_{71}} = (x_{36} - y_{36})\,\mathbf{a}_1 + (x_{36} + y_{36})\,\mathbf{a}_2 + z_{36}\,\mathbf{a}_3 = (ax_{36} + cz_{36}\cos\beta)\,\hat{\mathbf{x}} + by_{36}\,\hat{\mathbf{y}} + cz_{36}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXVIII}$$

$$\mathbf{B_{72}} = (x_{36} + y_{36})\,\mathbf{a}_1 + (x_{36} - y_{36})\,\mathbf{a}_2 + \left(z_{36} + \tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{36} + c\left(z_{36} + \tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{36}\,\hat{\mathbf{y}} + c\left(z_{36} + \tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXVIII}$$

$$\mathbf{B_{73}} = (x_{37} - y_{37})\,\mathbf{a}_1 + (x_{37} + y_{37})\,\mathbf{a}_2 + z_{37}\,\mathbf{a}_3 = (ax_{37} + cz_{37}\cos\beta)\,\hat{\mathbf{x}} + by_{37}\,\hat{\mathbf{y}} + cz_{37}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXIX}$$

$$\mathbf{B_{74}} = (x_{37} + y_{37})\,\mathbf{a}_1 + (x_{37} - y_{37})\,\mathbf{a}_2 + \left(z_{37} + \tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{37} + c\left(z_{37} + \tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{37}\,\hat{\mathbf{y}} + c\left(z_{37} + \tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXIX}$$

$$\mathbf{B_{75}} = (x_{38} - y_{38})\,\mathbf{a}_1 + (x_{38} + y_{38})\,\mathbf{a}_2 + z_{38}\,\mathbf{a}_3 = (ax_{38} + cz_{38}\cos\beta)\,\hat{\mathbf{x}} + by_{38}\,\hat{\mathbf{y}} + cz_{38}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXX}$$

$$\mathbf{B_{76}} = (x_{38} + y_{38})\,\mathbf{a}_1 + (x_{38} - y_{38})\,\mathbf{a}_2 + \left(z_{38} + \tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{38} + c\left(z_{38} + \tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{38}\,\hat{\mathbf{y}} + c\left(z_{38} + \tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXX}$$

$$\mathbf{B_{77}} = (x_{39} - y_{39})\,\mathbf{a}_1 + (x_{39} + y_{39})\,\mathbf{a}_2 + z_{39}\,\mathbf{a}_3 = (ax_{39} + cz_{39}\cos\beta)\,\hat{\mathbf{x}} + by_{39}\,\hat{\mathbf{y}} + cz_{39}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXXI}$$

$$\mathbf{B_{78}} = (x_{39} + y_{39})\,\mathbf{a}_1 + (x_{39} - y_{39})\,\mathbf{a}_2 + \left(z_{39} + \tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{39} + c\left(z_{39} + \tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{39}\,\hat{\mathbf{y}} + c\left(z_{39} + \tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXXI}$$

$$\mathbf{B_{79}} = (x_{40} - y_{40})\,\mathbf{a}_1 + (x_{40} + y_{40})\,\mathbf{a}_2 + z_{40}\,\mathbf{a}_3 = (ax_{40} + cz_{40}\cos\beta)\,\hat{\mathbf{x}} + by_{40}\,\hat{\mathbf{y}} + cz_{40}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXXII}$$

$$\mathbf{B_{80}} = (x_{40} + y_{40})\,\mathbf{a}_1 + (x_{40} - y_{40})\,\mathbf{a}_2 + \left(z_{40} + \tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{40} + c\left(z_{40} + \tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{40}\,\hat{\mathbf{y}} + c\left(z_{40} + \tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{O XXXII}$$

$$\mathbf{B_{81}} = (x_{41} - y_{41})\,\mathbf{a}_1 + (x_{41} + y_{41})\,\mathbf{a}_2 + z_{41}\,\mathbf{a}_3 = (ax_{41} + cz_{41}\cos\beta)\,\hat{\mathbf{x}} + by_{41}\,\hat{\mathbf{y}} + cz_{41}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{P I}$$

$$\mathbf{B_{82}} = (x_{41}+y_{41})\,\mathbf{a}_1 + (x_{41}-y_{41})\,\mathbf{a}_2 + \left(z_{41}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{41} + c\left(z_{41}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{41}\,\hat{\mathbf{y}} + c\left(z_{41}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{P I}$$

$$\mathbf{B_{83}} = (x_{42}-y_{42})\,\mathbf{a}_1 + (x_{42}+y_{42})\,\mathbf{a}_2 + z_{42}\,\mathbf{a}_3 = (ax_{42} + cz_{42}\cos\beta)\,\hat{\mathbf{x}} + by_{42}\,\hat{\mathbf{y}} + cz_{42}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{P II}$$

$$\mathbf{B_{84}} = (x_{42}+y_{42})\,\mathbf{a}_1 + (x_{42}-y_{42})\,\mathbf{a}_2 + \left(z_{42}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{42} + c\left(z_{42}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{42}\,\hat{\mathbf{y}} + c\left(z_{42}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{P II}$$

$$\mathbf{B_{85}} = (x_{43}-y_{43})\,\mathbf{a}_1 + (x_{43}+y_{43})\,\mathbf{a}_2 + z_{43}\,\mathbf{a}_3 = (ax_{43} + cz_{43}\cos\beta)\,\hat{\mathbf{x}} + by_{43}\,\hat{\mathbf{y}} + cz_{43}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{P III}$$

$$\mathbf{B_{86}} = (x_{43}+y_{43})\,\mathbf{a}_1 + (x_{43}-y_{43})\,\mathbf{a}_2 + \left(z_{43}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{43} + c\left(z_{43}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{43}\,\hat{\mathbf{y}} + c\left(z_{43}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{P III}$$

$$\mathbf{B_{87}} = (x_{44}-y_{44})\,\mathbf{a}_1 + (x_{44}+y_{44})\,\mathbf{a}_2 + z_{44}\,\mathbf{a}_3 = (ax_{44} + cz_{44}\cos\beta)\,\hat{\mathbf{x}} + by_{44}\,\hat{\mathbf{y}} + cz_{44}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{P IV}$$

$$\mathbf{B_{88}} = (x_{44}+y_{44})\,\mathbf{a}_1 + (x_{44}-y_{44})\,\mathbf{a}_2 + \left(z_{44}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{44} + c\left(z_{44}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{44}\,\hat{\mathbf{y}} + c\left(z_{44}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{P IV}$$

$$\mathbf{B_{89}} = (x_{45}-y_{45})\,\mathbf{a}_1 + (x_{45}+y_{45})\,\mathbf{a}_2 + z_{45}\,\mathbf{a}_3 = (ax_{45} + cz_{45}\cos\beta)\,\hat{\mathbf{x}} + by_{45}\,\hat{\mathbf{y}} + cz_{45}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{P V}$$

$$\mathbf{B_{90}} = (x_{45}+y_{45})\,\mathbf{a}_1 + (x_{45}-y_{45})\,\mathbf{a}_2 + \left(z_{45}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{45} + c\left(z_{45}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{45}\,\hat{\mathbf{y}} + c\left(z_{45}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{P V}$$

$$\mathbf{B_{91}} = (x_{46}-y_{46})\,\mathbf{a}_1 + (x_{46}+y_{46})\,\mathbf{a}_2 + z_{46}\,\mathbf{a}_3 = (ax_{46} + cz_{46}\cos\beta)\,\hat{\mathbf{x}} + by_{46}\,\hat{\mathbf{y}} + cz_{46}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{P VI}$$

$$\mathbf{B_{92}} = (x_{46}+y_{46})\,\mathbf{a}_1 + (x_{46}-y_{46})\,\mathbf{a}_2 + \left(z_{46}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{46} + c\left(z_{46}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{46}\,\hat{\mathbf{y}} + c\left(z_{46}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{P VI}$$

$$\mathbf{B_{93}} = (x_{47}-y_{47})\,\mathbf{a}_1 + (x_{47}+y_{47})\,\mathbf{a}_2 + z_{47}\,\mathbf{a}_3 = (ax_{47} + cz_{47}\cos\beta)\,\hat{\mathbf{x}} + by_{47}\,\hat{\mathbf{y}} + cz_{47}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{P VII}$$

$$\mathbf{B_{94}} = (x_{47}+y_{47})\,\mathbf{a}_1 + (x_{47}-y_{47})\,\mathbf{a}_2 + \left(z_{47}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{47} + c\left(z_{47}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{47}\,\hat{\mathbf{y}} + c\left(z_{47}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{P VII}$$

$$\mathbf{B_{95}} = (x_{48}-y_{48})\,\mathbf{a}_1 + (x_{48}+y_{48})\,\mathbf{a}_2 + z_{48}\,\mathbf{a}_3 = (ax_{48} + cz_{48}\cos\beta)\,\hat{\mathbf{x}} + by_{48}\,\hat{\mathbf{y}} + cz_{48}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{P VIII}$$

$$\mathbf{B_{96}} = (x_{48}+y_{48})\,\mathbf{a}_1 + (x_{48}-y_{48})\,\mathbf{a}_2 + \left(z_{48}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{48} + c\left(z_{48}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{48}\,\hat{\mathbf{y}} + c\left(z_{48}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{P VIII}$$

$$\mathbf{B_{97}} = (x_{49}-y_{49})\,\mathbf{a}_1 + (x_{49}+y_{49})\,\mathbf{a}_2 + z_{49}\,\mathbf{a}_3 = (ax_{49} + cz_{49}\cos\beta)\,\hat{\mathbf{x}} + by_{49}\,\hat{\mathbf{y}} + cz_{49}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{Zn I}$$

$$\mathbf{B_{98}} = (x_{49}+y_{49})\,\mathbf{a}_1 + (x_{49}-y_{49})\,\mathbf{a}_2 + \left(z_{49}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{49} + c\left(z_{49}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{49}\,\hat{\mathbf{y}} + c\left(z_{49}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{Zn I}$$

$$\mathbf{B_{99}} = (x_{50}-y_{50})\,\mathbf{a}_1 + (x_{50}+y_{50})\,\mathbf{a}_2 + z_{50}\,\mathbf{a}_3 = (ax_{50} + cz_{50}\cos\beta)\,\hat{\mathbf{x}} + by_{50}\,\hat{\mathbf{y}} + cz_{50}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{Zn II}$$

$$\mathbf{B_{100}} = (x_{50}+y_{50})\,\mathbf{a}_1 + (x_{50}-y_{50})\,\mathbf{a}_2 + \left(z_{50}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{50} + c\left(z_{50}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{50}\,\hat{\mathbf{y}} + c\left(z_{50}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{Zn II}$$

$$\mathbf{B_{101}} = (x_{51}-y_{51})\,\mathbf{a}_1 + (x_{51}+y_{51})\,\mathbf{a}_2 + z_{51}\,\mathbf{a}_3 = (ax_{51} + cz_{51}\cos\beta)\,\hat{\mathbf{x}} + by_{51}\,\hat{\mathbf{y}} + cz_{51}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{Zn III}$$

$$\mathbf{B_{102}} = (x_{51}+y_{51})\,\mathbf{a}_1 + (x_{51}-y_{51})\,\mathbf{a}_2 + \left(z_{51}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{51} + c\left(z_{51}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{51}\,\hat{\mathbf{y}} + c\left(z_{51}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{Zn III}$$

$$\mathbf{B_{103}} = (x_{52}-y_{52})\,\mathbf{a}_1 + (x_{52}+y_{52})\,\mathbf{a}_2 + z_{52}\,\mathbf{a}_3 = (ax_{52} + cz_{52}\cos\beta)\,\hat{\mathbf{x}} + by_{52}\,\hat{\mathbf{y}} + cz_{52}\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{Zn IV}$$

$$\mathbf{B_{104}} = (x_{52}+y_{52})\,\mathbf{a}_1 + (x_{52}-y_{52})\,\mathbf{a}_2 + \left(z_{52}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{52} + c\left(z_{52}+\tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{52}\,\hat{\mathbf{y}} + c\left(z_{52}+\tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad (4a) \quad \text{Zn IV}$$

$$\mathbf{B_{105}} = (x_{53} - y_{53})\,\mathbf{a}_1 + (x_{53} + y_{53})\,\mathbf{a}_2 + z_{53}\,\mathbf{a}_3 = (ax_{53} + cz_{53}\cos\beta)\,\hat{\mathbf{x}} + by_{53}\,\hat{\mathbf{y}} + cz_{53}\sin\beta\,\hat{\mathbf{z}} \quad \text{(4a)} \quad \text{Zn V}$$

$$\mathbf{B_{106}} = (x_{53} + y_{53})\,\mathbf{a}_1 + (x_{53} - y_{53})\,\mathbf{a}_2 + \left(z_{53} + \tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{53} + c\left(z_{53} + \tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{53}\,\hat{\mathbf{y}} + c\left(z_{53} + \tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad \text{(4a)} \quad \text{Zn V}$$

$$\mathbf{B_{107}} = (x_{54} - y_{54})\,\mathbf{a}_1 + (x_{54} + y_{54})\,\mathbf{a}_2 + z_{54}\,\mathbf{a}_3 = (ax_{54} + cz_{54}\cos\beta)\,\hat{\mathbf{x}} + by_{54}\,\hat{\mathbf{y}} + cz_{54}\sin\beta\,\hat{\mathbf{z}} \quad \text{(4a)} \quad \text{Zn VI}$$

$$\mathbf{B_{108}} = (x_{54} + y_{54})\,\mathbf{a}_1 + (x_{54} - y_{54})\,\mathbf{a}_2 + \left(z_{54} + \tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{54} + c\left(z_{54} + \tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{54}\,\hat{\mathbf{y}} + c\left(z_{54} + \tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad \text{(4a)} \quad \text{Zn VI}$$

$$\mathbf{B_{109}} = (x_{55} - y_{55})\,\mathbf{a}_1 + (x_{55} + y_{55})\,\mathbf{a}_2 + z_{55}\,\mathbf{a}_3 = (ax_{55} + cz_{55}\cos\beta)\,\hat{\mathbf{x}} + by_{55}\,\hat{\mathbf{y}} + cz_{55}\sin\beta\,\hat{\mathbf{z}} \quad \text{(4a)} \quad \text{Zn VII}$$

$$\mathbf{B_{110}} = (x_{55} + y_{55})\,\mathbf{a}_1 + (x_{55} - y_{55})\,\mathbf{a}_2 + \left(z_{55} + \tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{55} + c\left(z_{55} + \tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{55}\,\hat{\mathbf{y}} + c\left(z_{55} + \tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad \text{(4a)} \quad \text{Zn VII}$$

$$\mathbf{B_{111}} = (x_{56} - y_{56})\,\mathbf{a}_1 + (x_{56} + y_{56})\,\mathbf{a}_2 + z_{56}\,\mathbf{a}_3 = (ax_{56} + cz_{56}\cos\beta)\,\hat{\mathbf{x}} + by_{56}\,\hat{\mathbf{y}} + cz_{56}\sin\beta\,\hat{\mathbf{z}} \quad \text{(4a)} \quad \text{Zn VIII}$$

$$\mathbf{B_{112}} = (x_{56} + y_{56})\,\mathbf{a}_1 + (x_{56} - y_{56})\,\mathbf{a}_2 + \left(z_{56} + \tfrac{1}{2}\right)\,\mathbf{a}_3 = \left(ax_{56} + c\left(z_{56} + \tfrac{1}{2}\right)\cos\beta\right)\,\hat{\mathbf{x}} - by_{56}\,\hat{\mathbf{y}} + c\left(z_{56} + \tfrac{1}{2}\right)\sin\beta\,\hat{\mathbf{z}} \quad \text{(4a)} \quad \text{Zn VIII}$$

References

[1] L. Elammari and B. Elouadi, *Structure of α-$LiZnPO_4$*, Acta Crystallogr. Sect. C **45**, 1864–1867 (1989), doi:10.1107/S0108270189003094.

First cited in

H. Eckert, S. Divilov, M. J. Mehl, D. Hicks, A. C. Zettel, M. Esters, X. Campilongo, and S. Curtarolo, *The AFLOW Library of Crystallographic Prototypes: Part 4*, Comput. Mater. Sci. **240**, 112988 (2024), doi: 10.1016/j.commatsci.2024.112988.