

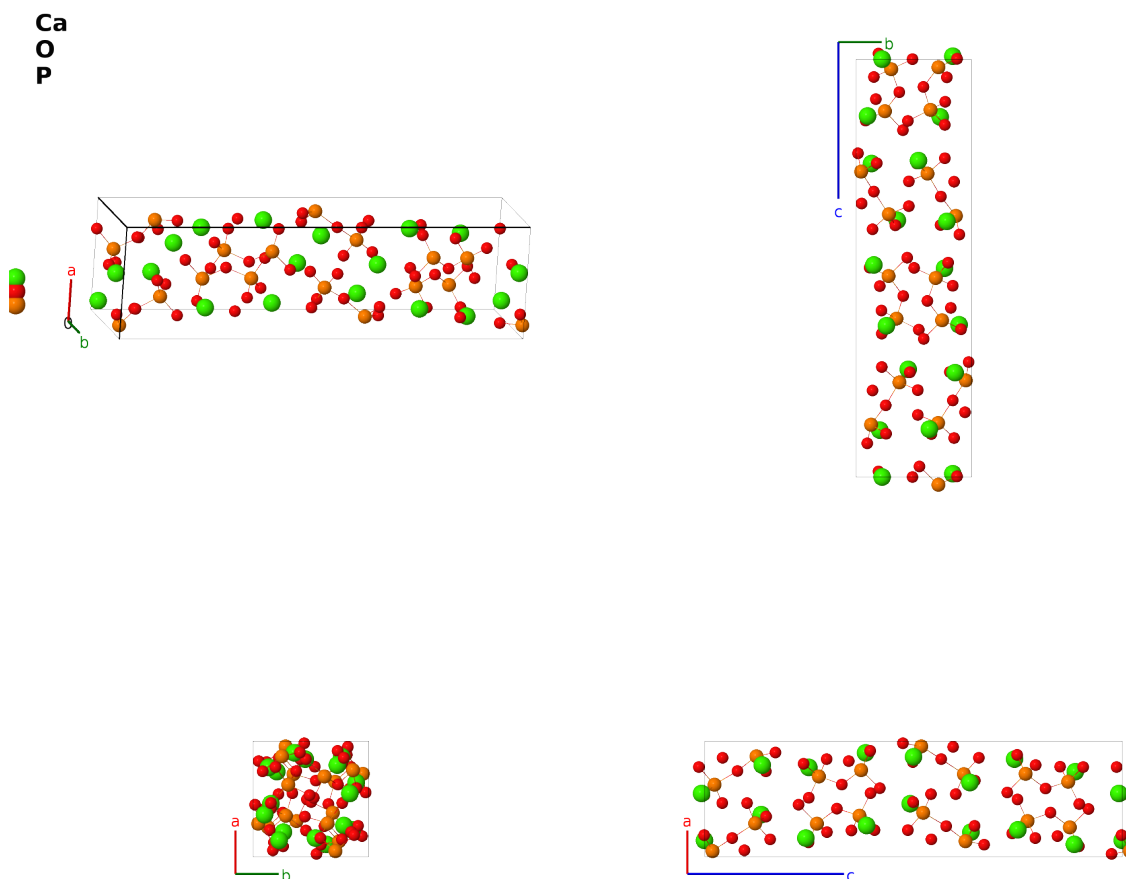
β -Ca₂P₂O₇ Structure: A2B7C2_tP88_76_4a_14a_4a-001

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<https://aflow.org/prototype-encyclopedia/BAJJ>

https://aflow.org/prototype-encyclopedia/A2B7C2_tP88_76_4a_14a_4a-001



Prototype	Ca ₂ O ₇ P ₂
AFLOW prototype label	A2B7C2_tP88_76_4a_14a_4a-001
ICSD	73712
CCDC	1634477
Pearson symbol	tP88

Space group number	76
Space group symbol	$P4_1$
AFLOW prototype command	aflow --proto=A2B7C2_tP88_76_4a_14a_4a-001 --params= $a, c/a, x_1, y_1, z_1, x_2, y_2, z_2, x_3, y_3, z_3, x_4, y_4, z_4, x_5, y_5, z_5, x_6, y_6, z_6, x_7, y_7, z_7, x_8, y_8, z_8, x_9, y_9, z_9, x_{10}, y_{10}, z_{10}, x_{11}, y_{11}, z_{11}, x_{12}, y_{12}, z_{12}, x_{13}, y_{13}, z_{13}, x_{14}, y_{14}, z_{14}, x_{15}, y_{15}, z_{15}, x_{16}, y_{16}, z_{16}, x_{17}, y_{17}, z_{17}, x_{18}, y_{18}, z_{18}, x_{19}, y_{19}, z_{19}, x_{20}, y_{20}, z_{20}, x_{21}, y_{21}, z_{21}, x_{22}, y_{22}, z_{22}$

Other compounds with this structure

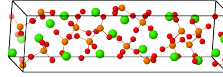
Eu₂Si₂O₇, La₂Si₂O₇, Nd₂Si₂O₇, Pr₂Si₂O₇, Sm₂Si₂O₇

- (Felsche, 1970) refers to this as the “A-RE₂Si₂O₇ structure, where “RE” is a rare-earth element.
- This is the low-temperature form of Ca₂P₂O₇. At higher temperatures it transforms into the monoclinic α -Ca₂P₂O₇ structure.
- The origin of the z -axis in space group $P4_1$ #76 is not specified. We fix it by setting $z_1 = 0$.

Simple Tetragonal primitive vectors

$$\begin{aligned}\mathbf{a}_1 &= a \hat{\mathbf{x}} \\ \mathbf{a}_2 &= a \hat{\mathbf{y}} \\ \mathbf{a}_3 &= c \hat{\mathbf{z}}\end{aligned}$$

$\begin{matrix} a_1 \\ a_2 \\ a_3 \end{matrix}$



Basis vectors

	Lattice coordinates		Cartesian coordinates	Wyckoff position	Atom type
$\mathbf{B}_1$	$= x_1 \mathbf{a}_1 + y_1 \mathbf{a}_2 + z_1 \mathbf{a}_3$	$=$	$ax_1 \hat{\mathbf{x}} + ay_1 \hat{\mathbf{y}} + cz_1 \hat{\mathbf{z}}$	(4a)	Ca I
$\mathbf{B}_2$	$= -x_1 \mathbf{a}_1 - y_1 \mathbf{a}_2 + (z_1 + \frac{1}{2}) \mathbf{a}_3$	$=$	$-ax_1 \hat{\mathbf{x}} - ay_1 \hat{\mathbf{y}} + c(z_1 + \frac{1}{2}) \hat{\mathbf{z}}$	(4a)	Ca I
$\mathbf{B}_3$	$= -y_1 \mathbf{a}_1 + x_1 \mathbf{a}_2 + (z_1 + \frac{1}{4}) \mathbf{a}_3$	$=$	$-ay_1 \hat{\mathbf{x}} + ax_1 \hat{\mathbf{y}} + c(z_1 + \frac{1}{4}) \hat{\mathbf{z}}$	(4a)	Ca I
$\mathbf{B}_4$	$= y_1 \mathbf{a}_1 - x_1 \mathbf{a}_2 + (z_1 + \frac{3}{4}) \mathbf{a}_3$	$=$	$ay_1 \hat{\mathbf{x}} - ax_1 \hat{\mathbf{y}} + c(z_1 + \frac{3}{4}) \hat{\mathbf{z}}$	(4a)	Ca I
$\mathbf{B}_5$	$= x_2 \mathbf{a}_1 + y_2 \mathbf{a}_2 + z_2 \mathbf{a}_3$	$=$	$ax_2 \hat{\mathbf{x}} + ay_2 \hat{\mathbf{y}} + cz_2 \hat{\mathbf{z}}$	(4a)	Ca II
$\mathbf{B}_6$	$= -x_2 \mathbf{a}_1 - y_2 \mathbf{a}_2 + (z_2 + \frac{1}{2}) \mathbf{a}_3$	$=$	$-ax_2 \hat{\mathbf{x}} - ay_2 \hat{\mathbf{y}} + c(z_2 + \frac{1}{2}) \hat{\mathbf{z}}$	(4a)	Ca II
$\mathbf{B}_7$	$= -y_2 \mathbf{a}_1 + x_2 \mathbf{a}_2 + (z_2 + \frac{1}{4}) \mathbf{a}_3$	$=$	$-ay_2 \hat{\mathbf{x}} + ax_2 \hat{\mathbf{y}} + c(z_2 + \frac{1}{4}) \hat{\mathbf{z}}$	(4a)	Ca II
$\mathbf{B}_8$	$= y_2 \mathbf{a}_1 - x_2 \mathbf{a}_2 + (z_2 + \frac{3}{4}) \mathbf{a}_3$	$=$	$ay_2 \hat{\mathbf{x}} - ax_2 \hat{\mathbf{y}} + c(z_2 + \frac{3}{4}) \hat{\mathbf{z}}$	(4a)	Ca II
$\mathbf{B}_9$	$= x_3 \mathbf{a}_1 + y_3 \mathbf{a}_2 + z_3 \mathbf{a}_3$	$=$	$ax_3 \hat{\mathbf{x}} + ay_3 \hat{\mathbf{y}} + cz_3 \hat{\mathbf{z}}$	(4a)	Ca III
$\mathbf{B}_{10}$	$= -x_3 \mathbf{a}_1 - y_3 \mathbf{a}_2 + (z_3 + \frac{1}{2}) \mathbf{a}_3$	$=$	$-ax_3 \hat{\mathbf{x}} - ay_3 \hat{\mathbf{y}} + c(z_3 + \frac{1}{2}) \hat{\mathbf{z}}$	(4a)	Ca III
$\mathbf{B}_{11}$	$= -y_3 \mathbf{a}_1 + x_3 \mathbf{a}_2 + (z_3 + \frac{1}{4}) \mathbf{a}_3$	$=$	$-ay_3 \hat{\mathbf{x}} + ax_3 \hat{\mathbf{y}} + c(z_3 + \frac{1}{4}) \hat{\mathbf{z}}$	(4a)	Ca III
$\mathbf{B}_{12}$	$= y_3 \mathbf{a}_1 - x_3 \mathbf{a}_2 + (z_3 + \frac{3}{4}) \mathbf{a}_3$	$=$	$ay_3 \hat{\mathbf{x}} - ax_3 \hat{\mathbf{y}} + c(z_3 + \frac{3}{4}) \hat{\mathbf{z}}$	(4a)	Ca III
$\mathbf{B}_{13}$	$= x_4 \mathbf{a}_1 + y_4 \mathbf{a}_2 + z_4 \mathbf{a}_3$	$=$	$ax_4 \hat{\mathbf{x}} + ay_4 \hat{\mathbf{y}} + cz_4 \hat{\mathbf{z}}$	(4a)	Ca IV
$\mathbf{B}_{14}$	$= -x_4 \mathbf{a}_1 - y_4 \mathbf{a}_2 + (z_4 + \frac{1}{2}) \mathbf{a}_3$	$=$	$-ax_4 \hat{\mathbf{x}} - ay_4 \hat{\mathbf{y}} + c(z_4 + \frac{1}{2}) \hat{\mathbf{z}}$	(4a)	Ca IV

$\mathbf{B}_{15} =$	$-y_4 \mathbf{a}_1 + x_4 \mathbf{a}_2 + (z_4 + \frac{1}{4}) \mathbf{a}_3$	$=$	$-ay_4 \hat{\mathbf{x}} + ax_4 \hat{\mathbf{y}} + c(z_4 + \frac{1}{4}) \hat{\mathbf{z}}$	(4a)	Ca IV
$\mathbf{B}_{16} =$	$y_4 \mathbf{a}_1 - x_4 \mathbf{a}_2 + (z_4 + \frac{3}{4}) \mathbf{a}_3$	$=$	$ay_4 \hat{\mathbf{x}} - ax_4 \hat{\mathbf{y}} + c(z_4 + \frac{3}{4}) \hat{\mathbf{z}}$	(4a)	Ca IV
$\mathbf{B}_{17} =$	$x_5 \mathbf{a}_1 + y_5 \mathbf{a}_2 + z_5 \mathbf{a}_3$	$=$	$ax_5 \hat{\mathbf{x}} + ay_5 \hat{\mathbf{y}} + cz_5 \hat{\mathbf{z}}$	(4a)	O I
$\mathbf{B}_{18} =$	$-x_5 \mathbf{a}_1 - y_5 \mathbf{a}_2 + (z_5 + \frac{1}{2}) \mathbf{a}_3$	$=$	$-ax_5 \hat{\mathbf{x}} - ay_5 \hat{\mathbf{y}} + c(z_5 + \frac{1}{2}) \hat{\mathbf{z}}$	(4a)	O I
$\mathbf{B}_{19} =$	$-y_5 \mathbf{a}_1 + x_5 \mathbf{a}_2 + (z_5 + \frac{1}{4}) \mathbf{a}_3$	$=$	$-ay_5 \hat{\mathbf{x}} + ax_5 \hat{\mathbf{y}} + c(z_5 + \frac{1}{4}) \hat{\mathbf{z}}$	(4a)	O I
$\mathbf{B}_{20} =$	$y_5 \mathbf{a}_1 - x_5 \mathbf{a}_2 + (z_5 + \frac{3}{4}) \mathbf{a}_3$	$=$	$ay_5 \hat{\mathbf{x}} - ax_5 \hat{\mathbf{y}} + c(z_5 + \frac{3}{4}) \hat{\mathbf{z}}$	(4a)	O I
$\mathbf{B}_{21} =$	$x_6 \mathbf{a}_1 + y_6 \mathbf{a}_2 + z_6 \mathbf{a}_3$	$=$	$ax_6 \hat{\mathbf{x}} + ay_6 \hat{\mathbf{y}} + cz_6 \hat{\mathbf{z}}$	(4a)	O II
$\mathbf{B}_{22} =$	$-x_6 \mathbf{a}_1 - y_6 \mathbf{a}_2 + (z_6 + \frac{1}{2}) \mathbf{a}_3$	$=$	$-ax_6 \hat{\mathbf{x}} - ay_6 \hat{\mathbf{y}} + c(z_6 + \frac{1}{2}) \hat{\mathbf{z}}$	(4a)	O II
$\mathbf{B}_{23} =$	$-y_6 \mathbf{a}_1 + x_6 \mathbf{a}_2 + (z_6 + \frac{1}{4}) \mathbf{a}_3$	$=$	$-ay_6 \hat{\mathbf{x}} + ax_6 \hat{\mathbf{y}} + c(z_6 + \frac{1}{4}) \hat{\mathbf{z}}$	(4a)	O II
$\mathbf{B}_{24} =$	$y_6 \mathbf{a}_1 - x_6 \mathbf{a}_2 + (z_6 + \frac{3}{4}) \mathbf{a}_3$	$=$	$ay_6 \hat{\mathbf{x}} - ax_6 \hat{\mathbf{y}} + c(z_6 + \frac{3}{4}) \hat{\mathbf{z}}$	(4a)	O II
$\mathbf{B}_{25} =$	$x_7 \mathbf{a}_1 + y_7 \mathbf{a}_2 + z_7 \mathbf{a}_3$	$=$	$ax_7 \hat{\mathbf{x}} + ay_7 \hat{\mathbf{y}} + cz_7 \hat{\mathbf{z}}$	(4a)	O III
$\mathbf{B}_{26} =$	$-x_7 \mathbf{a}_1 - y_7 \mathbf{a}_2 + (z_7 + \frac{1}{2}) \mathbf{a}_3$	$=$	$-ax_7 \hat{\mathbf{x}} - ay_7 \hat{\mathbf{y}} + c(z_7 + \frac{1}{2}) \hat{\mathbf{z}}$	(4a)	O III
$\mathbf{B}_{27} =$	$-y_7 \mathbf{a}_1 + x_7 \mathbf{a}_2 + (z_7 + \frac{1}{4}) \mathbf{a}_3$	$=$	$-ay_7 \hat{\mathbf{x}} + ax_7 \hat{\mathbf{y}} + c(z_7 + \frac{1}{4}) \hat{\mathbf{z}}$	(4a)	O III
$\mathbf{B}_{28} =$	$y_7 \mathbf{a}_1 - x_7 \mathbf{a}_2 + (z_7 + \frac{3}{4}) \mathbf{a}_3$	$=$	$ay_7 \hat{\mathbf{x}} - ax_7 \hat{\mathbf{y}} + c(z_7 + \frac{3}{4}) \hat{\mathbf{z}}$	(4a)	O III
$\mathbf{B}_{29} =$	$x_8 \mathbf{a}_1 + y_8 \mathbf{a}_2 + z_8 \mathbf{a}_3$	$=$	$ax_8 \hat{\mathbf{x}} + ay_8 \hat{\mathbf{y}} + cz_8 \hat{\mathbf{z}}$	(4a)	O IV
$\mathbf{B}_{30} =$	$-x_8 \mathbf{a}_1 - y_8 \mathbf{a}_2 + (z_8 + \frac{1}{2}) \mathbf{a}_3$	$=$	$-ax_8 \hat{\mathbf{x}} - ay_8 \hat{\mathbf{y}} + c(z_8 + \frac{1}{2}) \hat{\mathbf{z}}$	(4a)	O IV
$\mathbf{B}_{31} =$	$-y_8 \mathbf{a}_1 + x_8 \mathbf{a}_2 + (z_8 + \frac{1}{4}) \mathbf{a}_3$	$=$	$-ay_8 \hat{\mathbf{x}} + ax_8 \hat{\mathbf{y}} + c(z_8 + \frac{1}{4}) \hat{\mathbf{z}}$	(4a)	O IV
$\mathbf{B}_{32} =$	$y_8 \mathbf{a}_1 - x_8 \mathbf{a}_2 + (z_8 + \frac{3}{4}) \mathbf{a}_3$	$=$	$ay_8 \hat{\mathbf{x}} - ax_8 \hat{\mathbf{y}} + c(z_8 + \frac{3}{4}) \hat{\mathbf{z}}$	(4a)	O IV
$\mathbf{B}_{33} =$	$x_9 \mathbf{a}_1 + y_9 \mathbf{a}_2 + z_9 \mathbf{a}_3$	$=$	$ax_9 \hat{\mathbf{x}} + ay_9 \hat{\mathbf{y}} + cz_9 \hat{\mathbf{z}}$	(4a)	O V
$\mathbf{B}_{34} =$	$-x_9 \mathbf{a}_1 - y_9 \mathbf{a}_2 + (z_9 + \frac{1}{2}) \mathbf{a}_3$	$=$	$-ax_9 \hat{\mathbf{x}} - ay_9 \hat{\mathbf{y}} + c(z_9 + \frac{1}{2}) \hat{\mathbf{z}}$	(4a)	O V
$\mathbf{B}_{35} =$	$-y_9 \mathbf{a}_1 + x_9 \mathbf{a}_2 + (z_9 + \frac{1}{4}) \mathbf{a}_3$	$=$	$-ay_9 \hat{\mathbf{x}} + ax_9 \hat{\mathbf{y}} + c(z_9 + \frac{1}{4}) \hat{\mathbf{z}}$	(4a)	O V
$\mathbf{B}_{36} =$	$y_9 \mathbf{a}_1 - x_9 \mathbf{a}_2 + (z_9 + \frac{3}{4}) \mathbf{a}_3$	$=$	$ay_9 \hat{\mathbf{x}} - ax_9 \hat{\mathbf{y}} + c(z_9 + \frac{3}{4}) \hat{\mathbf{z}}$	(4a)	O V
$\mathbf{B}_{37} =$	$x_{10} \mathbf{a}_1 + y_{10} \mathbf{a}_2 + z_{10} \mathbf{a}_3$	$=$	$ax_{10} \hat{\mathbf{x}} + ay_{10} \hat{\mathbf{y}} + cz_{10} \hat{\mathbf{z}}$	(4a)	O VI
$\mathbf{B}_{38} =$	$-x_{10} \mathbf{a}_1 - y_{10} \mathbf{a}_2 + (z_{10} + \frac{1}{2}) \mathbf{a}_3$	$=$	$-ax_{10} \hat{\mathbf{x}} - ay_{10} \hat{\mathbf{y}} + c(z_{10} + \frac{1}{2}) \hat{\mathbf{z}}$	(4a)	O VI
$\mathbf{B}_{39} =$	$-y_{10} \mathbf{a}_1 + x_{10} \mathbf{a}_2 + (z_{10} + \frac{1}{4}) \mathbf{a}_3$	$=$	$-ay_{10} \hat{\mathbf{x}} + ax_{10} \hat{\mathbf{y}} + c(z_{10} + \frac{1}{4}) \hat{\mathbf{z}}$	(4a)	O VI
$\mathbf{B}_{40} =$	$y_{10} \mathbf{a}_1 - x_{10} \mathbf{a}_2 + (z_{10} + \frac{3}{4}) \mathbf{a}_3$	$=$	$ay_{10} \hat{\mathbf{x}} - ax_{10} \hat{\mathbf{y}} + c(z_{10} + \frac{3}{4}) \hat{\mathbf{z}}$	(4a)	O VI
$\mathbf{B}_{41} =$	$x_{11} \mathbf{a}_1 + y_{11} \mathbf{a}_2 + z_{11} \mathbf{a}_3$	$=$	$ax_{11} \hat{\mathbf{x}} + ay_{11} \hat{\mathbf{y}} + cz_{11} \hat{\mathbf{z}}$	(4a)	O VII
$\mathbf{B}_{42} =$	$-x_{11} \mathbf{a}_1 - y_{11} \mathbf{a}_2 + (z_{11} + \frac{1}{2}) \mathbf{a}_3$	$=$	$-ax_{11} \hat{\mathbf{x}} - ay_{11} \hat{\mathbf{y}} + c(z_{11} + \frac{1}{2}) \hat{\mathbf{z}}$	(4a)	O VII
$\mathbf{B}_{43} =$	$-y_{11} \mathbf{a}_1 + x_{11} \mathbf{a}_2 + (z_{11} + \frac{1}{4}) \mathbf{a}_3$	$=$	$-ay_{11} \hat{\mathbf{x}} + ax_{11} \hat{\mathbf{y}} + c(z_{11} + \frac{1}{4}) \hat{\mathbf{z}}$	(4a)	O VII
$\mathbf{B}_{44} =$	$y_{11} \mathbf{a}_1 - x_{11} \mathbf{a}_2 + (z_{11} + \frac{3}{4}) \mathbf{a}_3$	$=$	$ay_{11} \hat{\mathbf{x}} - ax_{11} \hat{\mathbf{y}} + c(z_{11} + \frac{3}{4}) \hat{\mathbf{z}}$	(4a)	O VII
$\mathbf{B}_{45} =$	$x_{12} \mathbf{a}_1 + y_{12} \mathbf{a}_2 + z_{12} \mathbf{a}_3$	$=$	$ax_{12} \hat{\mathbf{x}} + ay_{12} \hat{\mathbf{y}} + cz_{12} \hat{\mathbf{z}}$	(4a)	O VIII
$\mathbf{B}_{46} =$	$-x_{12} \mathbf{a}_1 - y_{12} \mathbf{a}_2 + (z_{12} + \frac{1}{2}) \mathbf{a}_3$	$=$	$-ax_{12} \hat{\mathbf{x}} - ay_{12} \hat{\mathbf{y}} + c(z_{12} + \frac{1}{2}) \hat{\mathbf{z}}$	(4a)	O VIII
$\mathbf{B}_{47} =$	$-y_{12} \mathbf{a}_1 + x_{12} \mathbf{a}_2 + (z_{12} + \frac{1}{4}) \mathbf{a}_3$	$=$	$-ay_{12} \hat{\mathbf{x}} + ax_{12} \hat{\mathbf{y}} + c(z_{12} + \frac{1}{4}) \hat{\mathbf{z}}$	(4a)	O VIII
$\mathbf{B}_{48} =$	$y_{12} \mathbf{a}_1 - x_{12} \mathbf{a}_2 + (z_{12} + \frac{3}{4}) \mathbf{a}_3$	$=$	$ay_{12} \hat{\mathbf{x}} - ax_{12} \hat{\mathbf{y}} + c(z_{12} + \frac{3}{4}) \hat{\mathbf{z}}$	(4a)	O VIII
$\mathbf{B}_{49} =$	$x_{13} \mathbf{a}_1 + y_{13} \mathbf{a}_2 + z_{13} \mathbf{a}_3$	$=$	$ax_{13} \hat{\mathbf{x}} + ay_{13} \hat{\mathbf{y}} + cz_{13} \hat{\mathbf{z}}$	(4a)	O IX
$\mathbf{B}_{50} =$	$-x_{13} \mathbf{a}_1 - y_{13} \mathbf{a}_2 + (z_{13} + \frac{1}{2}) \mathbf{a}_3$	$=$	$-ax_{13} \hat{\mathbf{x}} - ay_{13} \hat{\mathbf{y}} + c(z_{13} + \frac{1}{2}) \hat{\mathbf{z}}$	(4a)	O IX
$\mathbf{B}_{51} =$	$-y_{13} \mathbf{a}_1 + x_{13} \mathbf{a}_2 + (z_{13} + \frac{1}{4}) \mathbf{a}_3$	$=$	$-ay_{13} \hat{\mathbf{x}} + ax_{13} \hat{\mathbf{y}} + c(z_{13} + \frac{1}{4}) \hat{\mathbf{z}}$	(4a)	O IX
$\mathbf{B}_{52} =$	$y_{13} \mathbf{a}_1 - x_{13} \mathbf{a}_2 + (z_{13} + \frac{3}{4}) \mathbf{a}_3$	$=$	$ay_{13} \hat{\mathbf{x}} - ax_{13} \hat{\mathbf{y}} + c(z_{13} + \frac{3}{4}) \hat{\mathbf{z}}$	(4a)	O IX
$\mathbf{B}_{53} =$	$x_{14} \mathbf{a}_1 + y_{14} \mathbf{a}_2 + z_{14} \mathbf{a}_3$	$=$	$ax_{14} \hat{\mathbf{x}} + ay_{14} \hat{\mathbf{y}} + cz_{14} \hat{\mathbf{z}}$	(4a)	O X
$\mathbf{B}_{54} =$	$-x_{14} \mathbf{a}_1 - y_{14} \mathbf{a}_2 + (z_{14} + \frac{1}{2}) \mathbf{a}_3$	$=$	$-ax_{14} \hat{\mathbf{x}} - ay_{14} \hat{\mathbf{y}} + c(z_{14} + \frac{1}{2}) \hat{\mathbf{z}}$	(4a)	O X
$\mathbf{B}_{55} =$	$-y_{14} \mathbf{a}_1 + x_{14} \mathbf{a}_2 + (z_{14} + \frac{1}{4}) \mathbf{a}_3$	$=$	$-ay_{14} \hat{\mathbf{x}} + ax_{14} \hat{\mathbf{y}} + c(z_{14} + \frac{1}{4}) \hat{\mathbf{z}}$	(4a)	O X

$\mathbf{B}_{56} =$	$y_{14} \mathbf{a}_1 - x_{14} \mathbf{a}_2 + \left(z_{14} + \frac{3}{4}\right) \mathbf{a}_3$	$=$	$ay_{14} \hat{\mathbf{x}} - ax_{14} \hat{\mathbf{y}} + c \left(z_{14} + \frac{3}{4}\right) \hat{\mathbf{z}}$	(4a)	O X
$\mathbf{B}_{57} =$	$x_{15} \mathbf{a}_1 + y_{15} \mathbf{a}_2 + z_{15} \mathbf{a}_3$	$=$	$ax_{15} \hat{\mathbf{x}} + ay_{15} \hat{\mathbf{y}} + cz_{15} \hat{\mathbf{z}}$	(4a)	O XI
$\mathbf{B}_{58} =$	$-x_{15} \mathbf{a}_1 - y_{15} \mathbf{a}_2 + \left(z_{15} + \frac{1}{2}\right) \mathbf{a}_3$	$=$	$-ax_{15} \hat{\mathbf{x}} - ay_{15} \hat{\mathbf{y}} + c \left(z_{15} + \frac{1}{2}\right) \hat{\mathbf{z}}$	(4a)	O XI
$\mathbf{B}_{59} =$	$-y_{15} \mathbf{a}_1 + x_{15} \mathbf{a}_2 + \left(z_{15} + \frac{1}{4}\right) \mathbf{a}_3$	$=$	$-ay_{15} \hat{\mathbf{x}} + ax_{15} \hat{\mathbf{y}} + c \left(z_{15} + \frac{1}{4}\right) \hat{\mathbf{z}}$	(4a)	O XI
$\mathbf{B}_{60} =$	$y_{15} \mathbf{a}_1 - x_{15} \mathbf{a}_2 + \left(z_{15} + \frac{3}{4}\right) \mathbf{a}_3$	$=$	$ay_{15} \hat{\mathbf{x}} - ax_{15} \hat{\mathbf{y}} + c \left(z_{15} + \frac{3}{4}\right) \hat{\mathbf{z}}$	(4a)	O XI
$\mathbf{B}_{61} =$	$x_{16} \mathbf{a}_1 + y_{16} \mathbf{a}_2 + z_{16} \mathbf{a}_3$	$=$	$ax_{16} \hat{\mathbf{x}} + ay_{16} \hat{\mathbf{y}} + cz_{16} \hat{\mathbf{z}}$	(4a)	O XII
$\mathbf{B}_{62} =$	$-x_{16} \mathbf{a}_1 - y_{16} \mathbf{a}_2 + \left(z_{16} + \frac{1}{2}\right) \mathbf{a}_3$	$=$	$-ax_{16} \hat{\mathbf{x}} - ay_{16} \hat{\mathbf{y}} + c \left(z_{16} + \frac{1}{2}\right) \hat{\mathbf{z}}$	(4a)	O XII
$\mathbf{B}_{63} =$	$-y_{16} \mathbf{a}_1 + x_{16} \mathbf{a}_2 + \left(z_{16} + \frac{1}{4}\right) \mathbf{a}_3$	$=$	$-ay_{16} \hat{\mathbf{x}} + ax_{16} \hat{\mathbf{y}} + c \left(z_{16} + \frac{1}{4}\right) \hat{\mathbf{z}}$	(4a)	O XII
$\mathbf{B}_{64} =$	$y_{16} \mathbf{a}_1 - x_{16} \mathbf{a}_2 + \left(z_{16} + \frac{3}{4}\right) \mathbf{a}_3$	$=$	$ay_{16} \hat{\mathbf{x}} - ax_{16} \hat{\mathbf{y}} + c \left(z_{16} + \frac{3}{4}\right) \hat{\mathbf{z}}$	(4a)	O XII
$\mathbf{B}_{65} =$	$x_{17} \mathbf{a}_1 + y_{17} \mathbf{a}_2 + z_{17} \mathbf{a}_3$	$=$	$ax_{17} \hat{\mathbf{x}} + ay_{17} \hat{\mathbf{y}} + cz_{17} \hat{\mathbf{z}}$	(4a)	O XIII
$\mathbf{B}_{66} =$	$-x_{17} \mathbf{a}_1 - y_{17} \mathbf{a}_2 + \left(z_{17} + \frac{1}{2}\right) \mathbf{a}_3$	$=$	$-ax_{17} \hat{\mathbf{x}} - ay_{17} \hat{\mathbf{y}} + c \left(z_{17} + \frac{1}{2}\right) \hat{\mathbf{z}}$	(4a)	O XIII
$\mathbf{B}_{67} =$	$-y_{17} \mathbf{a}_1 + x_{17} \mathbf{a}_2 + \left(z_{17} + \frac{1}{4}\right) \mathbf{a}_3$	$=$	$-ay_{17} \hat{\mathbf{x}} + ax_{17} \hat{\mathbf{y}} + c \left(z_{17} + \frac{1}{4}\right) \hat{\mathbf{z}}$	(4a)	O XIII
$\mathbf{B}_{68} =$	$y_{17} \mathbf{a}_1 - x_{17} \mathbf{a}_2 + \left(z_{17} + \frac{3}{4}\right) \mathbf{a}_3$	$=$	$ay_{17} \hat{\mathbf{x}} - ax_{17} \hat{\mathbf{y}} + c \left(z_{17} + \frac{3}{4}\right) \hat{\mathbf{z}}$	(4a)	O XIII
$\mathbf{B}_{69} =$	$x_{18} \mathbf{a}_1 + y_{18} \mathbf{a}_2 + z_{18} \mathbf{a}_3$	$=$	$ax_{18} \hat{\mathbf{x}} + ay_{18} \hat{\mathbf{y}} + cz_{18} \hat{\mathbf{z}}$	(4a)	O XIV
$\mathbf{B}_{70} =$	$-x_{18} \mathbf{a}_1 - y_{18} \mathbf{a}_2 + \left(z_{18} + \frac{1}{2}\right) \mathbf{a}_3$	$=$	$-ax_{18} \hat{\mathbf{x}} - ay_{18} \hat{\mathbf{y}} + c \left(z_{18} + \frac{1}{2}\right) \hat{\mathbf{z}}$	(4a)	O XIV
$\mathbf{B}_{71} =$	$-y_{18} \mathbf{a}_1 + x_{18} \mathbf{a}_2 + \left(z_{18} + \frac{1}{4}\right) \mathbf{a}_3$	$=$	$-ay_{18} \hat{\mathbf{x}} + ax_{18} \hat{\mathbf{y}} + c \left(z_{18} + \frac{1}{4}\right) \hat{\mathbf{z}}$	(4a)	O XIV
$\mathbf{B}_{72} =$	$y_{18} \mathbf{a}_1 - x_{18} \mathbf{a}_2 + \left(z_{18} + \frac{3}{4}\right) \mathbf{a}_3$	$=$	$ay_{18} \hat{\mathbf{x}} - ax_{18} \hat{\mathbf{y}} + c \left(z_{18} + \frac{3}{4}\right) \hat{\mathbf{z}}$	(4a)	O XIV
$\mathbf{B}_{73} =$	$x_{19} \mathbf{a}_1 + y_{19} \mathbf{a}_2 + z_{19} \mathbf{a}_3$	$=$	$ax_{19} \hat{\mathbf{x}} + ay_{19} \hat{\mathbf{y}} + cz_{19} \hat{\mathbf{z}}$	(4a)	P I
$\mathbf{B}_{74} =$	$-x_{19} \mathbf{a}_1 - y_{19} \mathbf{a}_2 + \left(z_{19} + \frac{1}{2}\right) \mathbf{a}_3$	$=$	$-ax_{19} \hat{\mathbf{x}} - ay_{19} \hat{\mathbf{y}} + c \left(z_{19} + \frac{1}{2}\right) \hat{\mathbf{z}}$	(4a)	P I
$\mathbf{B}_{75} =$	$-y_{19} \mathbf{a}_1 + x_{19} \mathbf{a}_2 + \left(z_{19} + \frac{1}{4}\right) \mathbf{a}_3$	$=$	$-ay_{19} \hat{\mathbf{x}} + ax_{19} \hat{\mathbf{y}} + c \left(z_{19} + \frac{1}{4}\right) \hat{\mathbf{z}}$	(4a)	P I
$\mathbf{B}_{76} =$	$y_{19} \mathbf{a}_1 - x_{19} \mathbf{a}_2 + \left(z_{19} + \frac{3}{4}\right) \mathbf{a}_3$	$=$	$ay_{19} \hat{\mathbf{x}} - ax_{19} \hat{\mathbf{y}} + c \left(z_{19} + \frac{3}{4}\right) \hat{\mathbf{z}}$	(4a)	P I
$\mathbf{B}_{77} =$	$x_{20} \mathbf{a}_1 + y_{20} \mathbf{a}_2 + z_{20} \mathbf{a}_3$	$=$	$ax_{20} \hat{\mathbf{x}} + ay_{20} \hat{\mathbf{y}} + cz_{20} \hat{\mathbf{z}}$	(4a)	P II
$\mathbf{B}_{78} =$	$-x_{20} \mathbf{a}_1 - y_{20} \mathbf{a}_2 + \left(z_{20} + \frac{1}{2}\right) \mathbf{a}_3$	$=$	$-ax_{20} \hat{\mathbf{x}} - ay_{20} \hat{\mathbf{y}} + c \left(z_{20} + \frac{1}{2}\right) \hat{\mathbf{z}}$	(4a)	P II
$\mathbf{B}_{79} =$	$-y_{20} \mathbf{a}_1 + x_{20} \mathbf{a}_2 + \left(z_{20} + \frac{1}{4}\right) \mathbf{a}_3$	$=$	$-ay_{20} \hat{\mathbf{x}} + ax_{20} \hat{\mathbf{y}} + c \left(z_{20} + \frac{1}{4}\right) \hat{\mathbf{z}}$	(4a)	P II
$\mathbf{B}_{80} =$	$y_{20} \mathbf{a}_1 - x_{20} \mathbf{a}_2 + \left(z_{20} + \frac{3}{4}\right) \mathbf{a}_3$	$=$	$ay_{20} \hat{\mathbf{x}} - ax_{20} \hat{\mathbf{y}} + c \left(z_{20} + \frac{3}{4}\right) \hat{\mathbf{z}}$	(4a)	P II
$\mathbf{B}_{81} =$	$x_{21} \mathbf{a}_1 + y_{21} \mathbf{a}_2 + z_{21} \mathbf{a}_3$	$=$	$ax_{21} \hat{\mathbf{x}} + ay_{21} \hat{\mathbf{y}} + cz_{21} \hat{\mathbf{z}}$	(4a)	P III
$\mathbf{B}_{82} =$	$-x_{21} \mathbf{a}_1 - y_{21} \mathbf{a}_2 + \left(z_{21} + \frac{1}{2}\right) \mathbf{a}_3$	$=$	$-ax_{21} \hat{\mathbf{x}} - ay_{21} \hat{\mathbf{y}} + c \left(z_{21} + \frac{1}{2}\right) \hat{\mathbf{z}}$	(4a)	P III
$\mathbf{B}_{83} =$	$-y_{21} \mathbf{a}_1 + x_{21} \mathbf{a}_2 + \left(z_{21} + \frac{1}{4}\right) \mathbf{a}_3$	$=$	$-ay_{21} \hat{\mathbf{x}} + ax_{21} \hat{\mathbf{y}} + c \left(z_{21} + \frac{1}{4}\right) \hat{\mathbf{z}}$	(4a)	P III
$\mathbf{B}_{84} =$	$y_{21} \mathbf{a}_1 - x_{21} \mathbf{a}_2 + \left(z_{21} + \frac{3}{4}\right) \mathbf{a}_3$	$=$	$ay_{21} \hat{\mathbf{x}} - ax_{21} \hat{\mathbf{y}} + c \left(z_{21} + \frac{3}{4}\right) \hat{\mathbf{z}}$	(4a)	P III
$\mathbf{B}_{85} =$	$x_{22} \mathbf{a}_1 + y_{22} \mathbf{a}_2 + z_{22} \mathbf{a}_3$	$=$	$ax_{22} \hat{\mathbf{x}} + ay_{22} \hat{\mathbf{y}} + cz_{22} \hat{\mathbf{z}}$	(4a)	P IV
$\mathbf{B}_{86} =$	$-x_{22} \mathbf{a}_1 - y_{22} \mathbf{a}_2 + \left(z_{22} + \frac{1}{2}\right) \mathbf{a}_3$	$=$	$-ax_{22} \hat{\mathbf{x}} - ay_{22} \hat{\mathbf{y}} + c \left(z_{22} + \frac{1}{2}\right) \hat{\mathbf{z}}$	(4a)	P IV
$\mathbf{B}_{87} =$	$-y_{22} \mathbf{a}_1 + x_{22} \mathbf{a}_2 + \left(z_{22} + \frac{1}{4}\right) \mathbf{a}_3$	$=$	$-ay_{22} \hat{\mathbf{x}} + ax_{22} \hat{\mathbf{y}} + c \left(z_{22} + \frac{1}{4}\right) \hat{\mathbf{z}}$	(4a)	P IV
$\mathbf{B}_{88} =$	$y_{22} \mathbf{a}_1 - x_{22} \mathbf{a}_2 + \left(z_{22} + \frac{3}{4}\right) \mathbf{a}_3$	$=$	$ay_{22} \hat{\mathbf{x}} - ax_{22} \hat{\mathbf{y}} + c \left(z_{22} + \frac{3}{4}\right) \hat{\mathbf{z}}$	(4a)	P IV

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