

Monoclinic (Cc) Low Tridymite (SiO_2) Structure: A2B_mC144_9_24a_12a-001

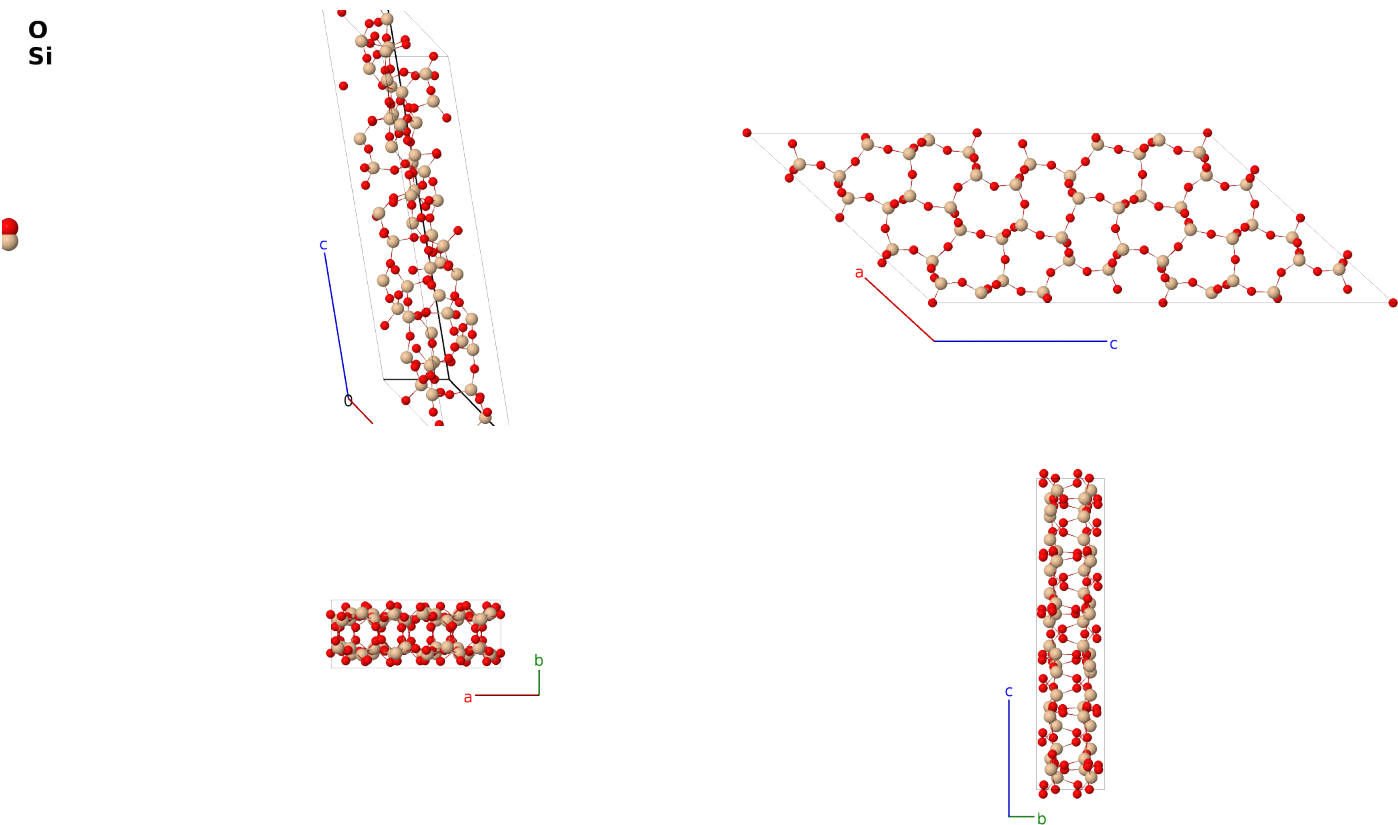
This structure previously used the label(s) **A2B_mC144_9_24a_12a**. Calls to these addresses will be redirected here.

Cite this page as:

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- 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/MK0W>

https://aflow.org/prototype-encyclopedia/A2B_mC144_9_24a_12a-001



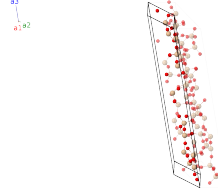
Prototype	O_2Si
AFLOW prototype label	A2B_mC144_9_24a_12a-001
ICSD	34867
CCDC	1607142
Pearson symbol	mC144
Space group number	9
Space group symbol	Cc

AFLOW prototype command `aflow --proto=A2B_mC144_9_24a_12a-001`
`--params=a,b/a,c/a,β,x1,y1,z1,x2,y2,z2,x3,y3,z3,x4,y4,z4,x5,y5,z5,x6,y6,z6,x7,y7,z7,x8,y8,z8,x9,y9,z9,x10,y10,z10,x11,y11,z11,x12,y12,z12,x13,y13,z13,x14,y14,z14,x15,y15,z15,x16,y16,z16,x17,y17,z17,x18,y18,z18,x19,y19,z19,x20,y20,z20,x21,y21,z21,x22,y22,z22,x23,y23,z23,x24,y24,z24,x25,y25,z25,x26,y26,z26,x27,y27,z27,x28,y28,z28,x29,y29,z29,x30,y30,z30,x31,y31,z31,x32,y32,z32,x33,y33,z33,x34,y34,z34,x35,y35,z35,x36,y36,z36`

- Tridymite undergoes a series of temperature-driven phase transitions. We also have an extensive list of the many phases of SiO₂ and related compounds.

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)	O I
$\mathbf{B}_2$	$(x_1 + y_1) \mathbf{a}_1 + (x_1 - y_1) \mathbf{a}_2 + (z_1 + \frac{1}{2}) \mathbf{a}_3$	=	$(ax_1 + c(z_1 + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_1 \hat{\mathbf{y}} + c(z_1 + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O 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)	O II
$\mathbf{B}_4$	$(x_2 + y_2) \mathbf{a}_1 + (x_2 - y_2) \mathbf{a}_2 + (z_2 + \frac{1}{2}) \mathbf{a}_3$	=	$(ax_2 + c(z_2 + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_2 \hat{\mathbf{y}} + c(z_2 + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O 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)	O III
$\mathbf{B}_6$	$(x_3 + y_3) \mathbf{a}_1 + (x_3 - y_3) \mathbf{a}_2 + (z_3 + \frac{1}{2}) \mathbf{a}_3$	=	$(ax_3 + c(z_3 + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_3 \hat{\mathbf{y}} + c(z_3 + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O 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)	O IV
$\mathbf{B}_8$	$(x_4 + y_4) \mathbf{a}_1 + (x_4 - y_4) \mathbf{a}_2 + (z_4 + \frac{1}{2}) \mathbf{a}_3$	=	$(ax_4 + c(z_4 + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_4 \hat{\mathbf{y}} + c(z_4 + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O 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)	O V
$\mathbf{B}_{10}$	$(x_5 + y_5) \mathbf{a}_1 + (x_5 - y_5) \mathbf{a}_2 + (z_5 + \frac{1}{2}) \mathbf{a}_3$	=	$(ax_5 + c(z_5 + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_5 \hat{\mathbf{y}} + c(z_5 + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O 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)	O VI
$\mathbf{B}_{12}$	$(x_6 + y_6) \mathbf{a}_1 + (x_6 - y_6) \mathbf{a}_2 + (z_6 + \frac{1}{2}) \mathbf{a}_3$	=	$(ax_6 + c(z_6 + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_6 \hat{\mathbf{y}} + c(z_6 + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O 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)	O VII

$\mathbf{B}_{14} =$	$(x_7 + y_7) \mathbf{a}_1 + (x_7 - y_7) \mathbf{a}_2 + (z_7 + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_7 + c(z_7 + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_7 \hat{\mathbf{y}} + c(z_7 + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O 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)	O VIII
$\mathbf{B}_{16} =$	$(x_8 + y_8) \mathbf{a}_1 + (x_8 - y_8) \mathbf{a}_2 + (z_8 + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_8 + c(z_8 + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_8 \hat{\mathbf{y}} + c(z_8 + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O 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 IX
$\mathbf{B}_{18} =$	$(x_9 + y_9) \mathbf{a}_1 + (x_9 - y_9) \mathbf{a}_2 + (z_9 + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_9 + c(z_9 + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_9 \hat{\mathbf{y}} + c(z_9 + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O IX
$\mathbf{B}_{19} =$	$(x_{10} - y_{10}) \mathbf{a}_1 + (x_{10} + y_{10}) \mathbf{a}_2 + z_{10} \mathbf{a}_3$	$=$	$(ax_{10} + cz_{10} \cos \beta) \hat{\mathbf{x}} + by_{10} \hat{\mathbf{y}} + cz_{10} \sin \beta \hat{\mathbf{z}}$	(4a)	O X
$\mathbf{B}_{20} =$	$(x_{10} + y_{10}) \mathbf{a}_1 + (x_{10} - y_{10}) \mathbf{a}_2 + (z_{10} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{10} + c(z_{10} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{10} \hat{\mathbf{y}} + c(z_{10} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O X
$\mathbf{B}_{21} =$	$(x_{11} - y_{11}) \mathbf{a}_1 + (x_{11} + y_{11}) \mathbf{a}_2 + z_{11} \mathbf{a}_3$	$=$	$(ax_{11} + cz_{11} \cos \beta) \hat{\mathbf{x}} + by_{11} \hat{\mathbf{y}} + cz_{11} \sin \beta \hat{\mathbf{z}}$	(4a)	O XI
$\mathbf{B}_{22} =$	$(x_{11} + y_{11}) \mathbf{a}_1 + (x_{11} - y_{11}) \mathbf{a}_2 + (z_{11} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{11} + c(z_{11} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{11} \hat{\mathbf{y}} + c(z_{11} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O XI
$\mathbf{B}_{23} =$	$(x_{12} - y_{12}) \mathbf{a}_1 + (x_{12} + y_{12}) \mathbf{a}_2 + z_{12} \mathbf{a}_3$	$=$	$(ax_{12} + cz_{12} \cos \beta) \hat{\mathbf{x}} + by_{12} \hat{\mathbf{y}} + cz_{12} \sin \beta \hat{\mathbf{z}}$	(4a)	O XII
$\mathbf{B}_{24} =$	$(x_{12} + y_{12}) \mathbf{a}_1 + (x_{12} - y_{12}) \mathbf{a}_2 + (z_{12} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{12} + c(z_{12} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{12} \hat{\mathbf{y}} + c(z_{12} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O XII
$\mathbf{B}_{25} =$	$(x_{13} - y_{13}) \mathbf{a}_1 + (x_{13} + y_{13}) \mathbf{a}_2 + z_{13} \mathbf{a}_3$	$=$	$(ax_{13} + cz_{13} \cos \beta) \hat{\mathbf{x}} + by_{13} \hat{\mathbf{y}} + cz_{13} \sin \beta \hat{\mathbf{z}}$	(4a)	O XIII
$\mathbf{B}_{26} =$	$(x_{13} + y_{13}) \mathbf{a}_1 + (x_{13} - y_{13}) \mathbf{a}_2 + (z_{13} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{13} + c(z_{13} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{13} \hat{\mathbf{y}} + c(z_{13} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O XIII
$\mathbf{B}_{27} =$	$(x_{14} - y_{14}) \mathbf{a}_1 + (x_{14} + y_{14}) \mathbf{a}_2 + z_{14} \mathbf{a}_3$	$=$	$(ax_{14} + cz_{14} \cos \beta) \hat{\mathbf{x}} + by_{14} \hat{\mathbf{y}} + cz_{14} \sin \beta \hat{\mathbf{z}}$	(4a)	O XIV
$\mathbf{B}_{28} =$	$(x_{14} + y_{14}) \mathbf{a}_1 + (x_{14} - y_{14}) \mathbf{a}_2 + (z_{14} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{14} + c(z_{14} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{14} \hat{\mathbf{y}} + c(z_{14} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O XIV
$\mathbf{B}_{29} =$	$(x_{15} - y_{15}) \mathbf{a}_1 + (x_{15} + y_{15}) \mathbf{a}_2 + z_{15} \mathbf{a}_3$	$=$	$(ax_{15} + cz_{15} \cos \beta) \hat{\mathbf{x}} + by_{15} \hat{\mathbf{y}} + cz_{15} \sin \beta \hat{\mathbf{z}}$	(4a)	O XV
$\mathbf{B}_{30} =$	$(x_{15} + y_{15}) \mathbf{a}_1 + (x_{15} - y_{15}) \mathbf{a}_2 + (z_{15} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{15} + c(z_{15} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{15} \hat{\mathbf{y}} + c(z_{15} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O XV
$\mathbf{B}_{31} =$	$(x_{16} - y_{16}) \mathbf{a}_1 + (x_{16} + y_{16}) \mathbf{a}_2 + z_{16} \mathbf{a}_3$	$=$	$(ax_{16} + cz_{16} \cos \beta) \hat{\mathbf{x}} + by_{16} \hat{\mathbf{y}} + cz_{16} \sin \beta \hat{\mathbf{z}}$	(4a)	O XVI
$\mathbf{B}_{32} =$	$(x_{16} + y_{16}) \mathbf{a}_1 + (x_{16} - y_{16}) \mathbf{a}_2 + (z_{16} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{16} + c(z_{16} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{16} \hat{\mathbf{y}} + c(z_{16} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O XVI
$\mathbf{B}_{33} =$	$(x_{17} - y_{17}) \mathbf{a}_1 + (x_{17} + y_{17}) \mathbf{a}_2 + z_{17} \mathbf{a}_3$	$=$	$(ax_{17} + cz_{17} \cos \beta) \hat{\mathbf{x}} + by_{17} \hat{\mathbf{y}} + cz_{17} \sin \beta \hat{\mathbf{z}}$	(4a)	O XVII
$\mathbf{B}_{34} =$	$(x_{17} + y_{17}) \mathbf{a}_1 + (x_{17} - y_{17}) \mathbf{a}_2 + (z_{17} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{17} + c(z_{17} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{17} \hat{\mathbf{y}} + c(z_{17} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O XVII
$\mathbf{B}_{35} =$	$(x_{18} - y_{18}) \mathbf{a}_1 + (x_{18} + y_{18}) \mathbf{a}_2 + z_{18} \mathbf{a}_3$	$=$	$(ax_{18} + cz_{18} \cos \beta) \hat{\mathbf{x}} + by_{18} \hat{\mathbf{y}} + cz_{18} \sin \beta \hat{\mathbf{z}}$	(4a)	O XVIII
$\mathbf{B}_{36} =$	$(x_{18} + y_{18}) \mathbf{a}_1 + (x_{18} - y_{18}) \mathbf{a}_2 + (z_{18} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{18} + c(z_{18} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{18} \hat{\mathbf{y}} + c(z_{18} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O XVIII

$\mathbf{B}_{37} =$	$(x_{19} - y_{19}) \mathbf{a}_1 +$ $(x_{19} + y_{19}) \mathbf{a}_2 + z_{19} \mathbf{a}_3$	$=$	$(ax_{19} + cz_{19} \cos \beta) \hat{\mathbf{x}} + by_{19} \hat{\mathbf{y}} + cz_{19} \sin \beta \hat{\mathbf{z}}$	(4a)	O XIX
$\mathbf{B}_{38} =$	$(x_{19} + y_{19}) \mathbf{a}_1 +$ $(x_{19} - y_{19}) \mathbf{a}_2 + (z_{19} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{19} + c(z_{19} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{19} \hat{\mathbf{y}} +$ $c(z_{19} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O XIX
$\mathbf{B}_{39} =$	$(x_{20} - y_{20}) \mathbf{a}_1 +$ $(x_{20} + y_{20}) \mathbf{a}_2 + z_{20} \mathbf{a}_3$	$=$	$(ax_{20} + cz_{20} \cos \beta) \hat{\mathbf{x}} + by_{20} \hat{\mathbf{y}} + cz_{20} \sin \beta \hat{\mathbf{z}}$	(4a)	O XX
$\mathbf{B}_{40} =$	$(x_{20} + y_{20}) \mathbf{a}_1 +$ $(x_{20} - y_{20}) \mathbf{a}_2 + (z_{20} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{20} + c(z_{20} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{20} \hat{\mathbf{y}} +$ $c(z_{20} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O XX
$\mathbf{B}_{41} =$	$(x_{21} - y_{21}) \mathbf{a}_1 +$ $(x_{21} + y_{21}) \mathbf{a}_2 + z_{21} \mathbf{a}_3$	$=$	$(ax_{21} + cz_{21} \cos \beta) \hat{\mathbf{x}} + by_{21} \hat{\mathbf{y}} + cz_{21} \sin \beta \hat{\mathbf{z}}$	(4a)	O XXI
$\mathbf{B}_{42} =$	$(x_{21} + y_{21}) \mathbf{a}_1 +$ $(x_{21} - y_{21}) \mathbf{a}_2 + (z_{21} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{21} + c(z_{21} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{21} \hat{\mathbf{y}} +$ $c(z_{21} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O XXI
$\mathbf{B}_{43} =$	$(x_{22} - y_{22}) \mathbf{a}_1 +$ $(x_{22} + y_{22}) \mathbf{a}_2 + z_{22} \mathbf{a}_3$	$=$	$(ax_{22} + cz_{22} \cos \beta) \hat{\mathbf{x}} + by_{22} \hat{\mathbf{y}} + cz_{22} \sin \beta \hat{\mathbf{z}}$	(4a)	O XXII
$\mathbf{B}_{44} =$	$(x_{22} + y_{22}) \mathbf{a}_1 +$ $(x_{22} - y_{22}) \mathbf{a}_2 + (z_{22} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{22} + c(z_{22} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{22} \hat{\mathbf{y}} +$ $c(z_{22} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O XXII
$\mathbf{B}_{45} =$	$(x_{23} - y_{23}) \mathbf{a}_1 +$ $(x_{23} + y_{23}) \mathbf{a}_2 + z_{23} \mathbf{a}_3$	$=$	$(ax_{23} + cz_{23} \cos \beta) \hat{\mathbf{x}} + by_{23} \hat{\mathbf{y}} + cz_{23} \sin \beta \hat{\mathbf{z}}$	(4a)	O XXIII
$\mathbf{B}_{46} =$	$(x_{23} + y_{23}) \mathbf{a}_1 +$ $(x_{23} - y_{23}) \mathbf{a}_2 + (z_{23} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{23} + c(z_{23} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{23} \hat{\mathbf{y}} +$ $c(z_{23} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O XXIII
$\mathbf{B}_{47} =$	$(x_{24} - y_{24}) \mathbf{a}_1 +$ $(x_{24} + y_{24}) \mathbf{a}_2 + z_{24} \mathbf{a}_3$	$=$	$(ax_{24} + cz_{24} \cos \beta) \hat{\mathbf{x}} + by_{24} \hat{\mathbf{y}} + cz_{24} \sin \beta \hat{\mathbf{z}}$	(4a)	O XXIV
$\mathbf{B}_{48} =$	$(x_{24} + y_{24}) \mathbf{a}_1 +$ $(x_{24} - y_{24}) \mathbf{a}_2 + (z_{24} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{24} + c(z_{24} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{24} \hat{\mathbf{y}} +$ $c(z_{24} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	O XXIV
$\mathbf{B}_{49} =$	$(x_{25} - y_{25}) \mathbf{a}_1 +$ $(x_{25} + y_{25}) \mathbf{a}_2 + z_{25} \mathbf{a}_3$	$=$	$(ax_{25} + cz_{25} \cos \beta) \hat{\mathbf{x}} + by_{25} \hat{\mathbf{y}} + cz_{25} \sin \beta \hat{\mathbf{z}}$	(4a)	Si I
$\mathbf{B}_{50} =$	$(x_{25} + y_{25}) \mathbf{a}_1 +$ $(x_{25} - y_{25}) \mathbf{a}_2 + (z_{25} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{25} + c(z_{25} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{25} \hat{\mathbf{y}} +$ $c(z_{25} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	Si I
$\mathbf{B}_{51} =$	$(x_{26} - y_{26}) \mathbf{a}_1 +$ $(x_{26} + y_{26}) \mathbf{a}_2 + z_{26} \mathbf{a}_3$	$=$	$(ax_{26} + cz_{26} \cos \beta) \hat{\mathbf{x}} + by_{26} \hat{\mathbf{y}} + cz_{26} \sin \beta \hat{\mathbf{z}}$	(4a)	Si II
$\mathbf{B}_{52} =$	$(x_{26} + y_{26}) \mathbf{a}_1 +$ $(x_{26} - y_{26}) \mathbf{a}_2 + (z_{26} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{26} + c(z_{26} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{26} \hat{\mathbf{y}} +$ $c(z_{26} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	Si II
$\mathbf{B}_{53} =$	$(x_{27} - y_{27}) \mathbf{a}_1 +$ $(x_{27} + y_{27}) \mathbf{a}_2 + z_{27} \mathbf{a}_3$	$=$	$(ax_{27} + cz_{27} \cos \beta) \hat{\mathbf{x}} + by_{27} \hat{\mathbf{y}} + cz_{27} \sin \beta \hat{\mathbf{z}}$	(4a)	Si III
$\mathbf{B}_{54} =$	$(x_{27} + y_{27}) \mathbf{a}_1 +$ $(x_{27} - y_{27}) \mathbf{a}_2 + (z_{27} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{27} + c(z_{27} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{27} \hat{\mathbf{y}} +$ $c(z_{27} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	Si III
$\mathbf{B}_{55} =$	$(x_{28} - y_{28}) \mathbf{a}_1 +$ $(x_{28} + y_{28}) \mathbf{a}_2 + z_{28} \mathbf{a}_3$	$=$	$(ax_{28} + cz_{28} \cos \beta) \hat{\mathbf{x}} + by_{28} \hat{\mathbf{y}} + cz_{28} \sin \beta \hat{\mathbf{z}}$	(4a)	Si IV
$\mathbf{B}_{56} =$	$(x_{28} + y_{28}) \mathbf{a}_1 +$ $(x_{28} - y_{28}) \mathbf{a}_2 + (z_{28} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{28} + c(z_{28} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{28} \hat{\mathbf{y}} +$ $c(z_{28} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	Si IV
$\mathbf{B}_{57} =$	$(x_{29} - y_{29}) \mathbf{a}_1 +$ $(x_{29} + y_{29}) \mathbf{a}_2 + z_{29} \mathbf{a}_3$	$=$	$(ax_{29} + cz_{29} \cos \beta) \hat{\mathbf{x}} + by_{29} \hat{\mathbf{y}} + cz_{29} \sin \beta \hat{\mathbf{z}}$	(4a)	Si V
$\mathbf{B}_{58} =$	$(x_{29} + y_{29}) \mathbf{a}_1 +$ $(x_{29} - y_{29}) \mathbf{a}_2 + (z_{29} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{29} + c(z_{29} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{29} \hat{\mathbf{y}} +$ $c(z_{29} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	Si V
$\mathbf{B}_{59} =$	$(x_{30} - y_{30}) \mathbf{a}_1 +$ $(x_{30} + y_{30}) \mathbf{a}_2 + z_{30} \mathbf{a}_3$	$=$	$(ax_{30} + cz_{30} \cos \beta) \hat{\mathbf{x}} + by_{30} \hat{\mathbf{y}} + cz_{30} \sin \beta \hat{\mathbf{z}}$	(4a)	Si VI

$\mathbf{B}_{60} =$	$(x_{30} + y_{30}) \mathbf{a}_1 +$ $(x_{30} - y_{30}) \mathbf{a}_2 + (z_{30} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{30} + c(z_{30} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{30} \hat{\mathbf{y}} +$ $c(z_{30} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	Si VI
$\mathbf{B}_{61} =$	$(x_{31} - y_{31}) \mathbf{a}_1 +$ $(x_{31} + y_{31}) \mathbf{a}_2 + z_{31} \mathbf{a}_3$	$=$	$(ax_{31} + cz_{31} \cos \beta) \hat{\mathbf{x}} + by_{31} \hat{\mathbf{y}} + cz_{31} \sin \beta \hat{\mathbf{z}}$	(4a)	Si VII
$\mathbf{B}_{62} =$	$(x_{31} + y_{31}) \mathbf{a}_1 +$ $(x_{31} - y_{31}) \mathbf{a}_2 + (z_{31} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{31} + c(z_{31} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{31} \hat{\mathbf{y}} +$ $c(z_{31} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	Si VII
$\mathbf{B}_{63} =$	$(x_{32} - y_{32}) \mathbf{a}_1 +$ $(x_{32} + y_{32}) \mathbf{a}_2 + z_{32} \mathbf{a}_3$	$=$	$(ax_{32} + cz_{32} \cos \beta) \hat{\mathbf{x}} + by_{32} \hat{\mathbf{y}} + cz_{32} \sin \beta \hat{\mathbf{z}}$	(4a)	Si VIII
$\mathbf{B}_{64} =$	$(x_{32} + y_{32}) \mathbf{a}_1 +$ $(x_{32} - y_{32}) \mathbf{a}_2 + (z_{32} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{32} + c(z_{32} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{32} \hat{\mathbf{y}} +$ $c(z_{32} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	Si VIII
$\mathbf{B}_{65} =$	$(x_{33} - y_{33}) \mathbf{a}_1 +$ $(x_{33} + y_{33}) \mathbf{a}_2 + z_{33} \mathbf{a}_3$	$=$	$(ax_{33} + cz_{33} \cos \beta) \hat{\mathbf{x}} + by_{33} \hat{\mathbf{y}} + cz_{33} \sin \beta \hat{\mathbf{z}}$	(4a)	Si IX
$\mathbf{B}_{66} =$	$(x_{33} + y_{33}) \mathbf{a}_1 +$ $(x_{33} - y_{33}) \mathbf{a}_2 + (z_{33} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{33} + c(z_{33} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{33} \hat{\mathbf{y}} +$ $c(z_{33} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	Si IX
$\mathbf{B}_{67} =$	$(x_{34} - y_{34}) \mathbf{a}_1 +$ $(x_{34} + y_{34}) \mathbf{a}_2 + z_{34} \mathbf{a}_3$	$=$	$(ax_{34} + cz_{34} \cos \beta) \hat{\mathbf{x}} + by_{34} \hat{\mathbf{y}} + cz_{34} \sin \beta \hat{\mathbf{z}}$	(4a)	Si X
$\mathbf{B}_{68} =$	$(x_{34} + y_{34}) \mathbf{a}_1 +$ $(x_{34} - y_{34}) \mathbf{a}_2 + (z_{34} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{34} + c(z_{34} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{34} \hat{\mathbf{y}} +$ $c(z_{34} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	Si X
$\mathbf{B}_{69} =$	$(x_{35} - y_{35}) \mathbf{a}_1 +$ $(x_{35} + y_{35}) \mathbf{a}_2 + z_{35} \mathbf{a}_3$	$=$	$(ax_{35} + cz_{35} \cos \beta) \hat{\mathbf{x}} + by_{35} \hat{\mathbf{y}} + cz_{35} \sin \beta \hat{\mathbf{z}}$	(4a)	Si XI
$\mathbf{B}_{70} =$	$(x_{35} + y_{35}) \mathbf{a}_1 +$ $(x_{35} - y_{35}) \mathbf{a}_2 + (z_{35} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{35} + c(z_{35} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{35} \hat{\mathbf{y}} +$ $c(z_{35} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	Si XI
$\mathbf{B}_{71} =$	$(x_{36} - y_{36}) \mathbf{a}_1 +$ $(x_{36} + y_{36}) \mathbf{a}_2 + z_{36} \mathbf{a}_3$	$=$	$(ax_{36} + cz_{36} \cos \beta) \hat{\mathbf{x}} + by_{36} \hat{\mathbf{y}} + cz_{36} \sin \beta \hat{\mathbf{z}}$	(4a)	Si XII
$\mathbf{B}_{72} =$	$(x_{36} + y_{36}) \mathbf{a}_1 +$ $(x_{36} - y_{36}) \mathbf{a}_2 + (z_{36} + \frac{1}{2}) \mathbf{a}_3$	$=$	$(ax_{36} + c(z_{36} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{36} \hat{\mathbf{y}} +$ $c(z_{36} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$	(4a)	Si XII

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