Orthorhombic Nb$_{12}$O$_{29}$ Structure: A12B29_oC164_63_6f_3c13f-001

https://aflow.org/p/V0KX

https://aflow.org/p/A12B29_oC164_63_6f_3c13f-001

● Nb
● O
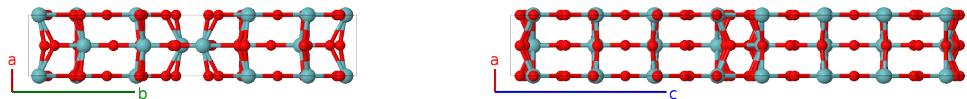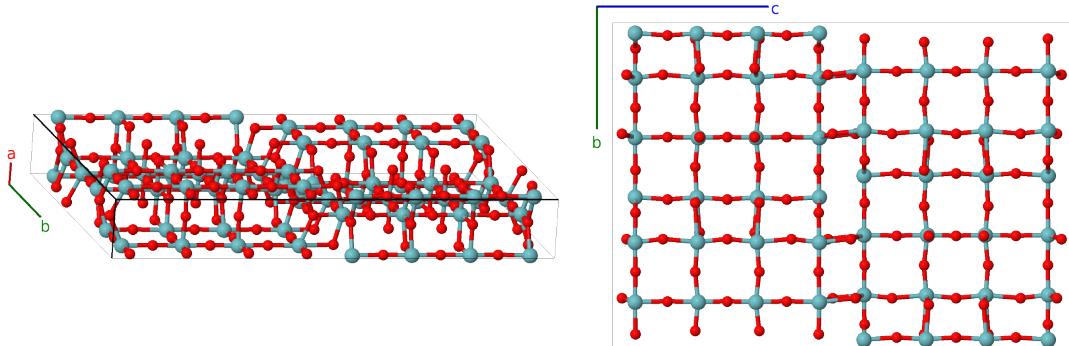
Prototype	Nb$_{12}$O$_{29}$
AFLOW prototype label	A12B29_oC164_63_6f_3c13f-001
ICSD	24089

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		Pearson symbol	oC164

Pearson symbol   oC164

Space group number   63

Space group symbol $Cmcm$

AFLOW prototype command   aflow --proto=A12B29_oC164_63_6f_3c13f-001
         --params=$a, b/a, c/a, y_1, y_2, y_3, y_4, z_4, y_5, z_5, y_6, z_6, y_7, z_7, y_8, z_8, y_9, z_9, y_{10}, z_{10}, y_{11}, z_{11},$
$y_{12}, z_{12}, y_{13}, z_{13}, y_{14}, z_{14}, y_{15}, z_{15}, y_{16}, z_{16}, y_{17}, z_{17}, y_{18}, z_{18}, y_{19}, z_{19}, y_{20}, z_{20}, y_{21}, z_{21}, y_{22}, z_{22}$

Other compounds with this structure
$Ti_2Nb_{10}O_{29}$

- $Nb_{12}O_{29}$ is known to exist in a least two phases (Norin, 1963; Norin, 1966):

  - a monoclinic phase and

  - an orthorhombic phase (this structure).

- (Wadsley, 1961) earlier found that both known phases of $Ti_2Nb_{12}O_{29}$ are isostructural with the corresponding $Nb_{12}O_{29}$ phase, but as the titanium and niobium atoms are alloyed on the same site we use the binary $Nb_{12}O_{29}$ as the prototype.

- (Norin, 1963) gives the structure of orthorhombic $Nb_{12}O_{29}$ in the $Amma$ setting of space group #63. We used FINDSYM to transform it to the standard $Cmcm$ setting.

Base-centered Orthorhombic primitive vectors

$$\mathbf{a_1} = \tfrac{1}{2}a\,\hat{\mathbf{x}} - \tfrac{1}{2}b\,\hat{\mathbf{y}}$$
$$\mathbf{a_2} = \tfrac{1}{2}a\,\hat{\mathbf{x}} + \tfrac{1}{2}b\,\hat{\mathbf{y}}$$
$$\mathbf{a_3} = c\,\hat{\mathbf{z}}$$

Basis vectors

		Lattice coordinates		Cartesian coordinates	Wyckoff position	Atom type
$\mathbf{B_1}$	$=$	$-y_1\,\mathbf{a_1} + y_1\,\mathbf{a_2} + \tfrac{1}{4}\,\mathbf{a_3}$	$=$	$by_1\,\hat{\mathbf{y}} + \tfrac{1}{4}c\,\hat{\mathbf{z}}$	(4c)	O I
$\mathbf{B_2}$	$=$	$y_1\,\mathbf{a_1} - y_1\,\mathbf{a_2} + \tfrac{3}{4}\,\mathbf{a_3}$	$=$	$-by_1\,\hat{\mathbf{y}} + \tfrac{3}{4}c\,\hat{\mathbf{z}}$	(4c)	O I
$\mathbf{B_3}$	$=$	$-y_2\,\mathbf{a_1} + y_2\,\mathbf{a_2} + \tfrac{1}{4}\,\mathbf{a_3}$	$=$	$by_2\,\hat{\mathbf{y}} + \tfrac{1}{4}c\,\hat{\mathbf{z}}$	(4c)	O II
$\mathbf{B_4}$	$=$	$y_2\,\mathbf{a_1} - y_2\,\mathbf{a_2} + \tfrac{3}{4}\,\mathbf{a_3}$	$=$	$-by_2\,\hat{\mathbf{y}} + \tfrac{3}{4}c\,\hat{\mathbf{z}}$	(4c)	O II
$\mathbf{B_5}$	$=$	$-y_3\,\mathbf{a_1} + y_3\,\mathbf{a_2} + \tfrac{1}{4}\,\mathbf{a_3}$	$=$	$by_3\,\hat{\mathbf{y}} + \tfrac{1}{4}c\,\hat{\mathbf{z}}$	(4c)	O III
$\mathbf{B_6}$	$=$	$y_3\,\mathbf{a_1} - y_3\,\mathbf{a_2} + \tfrac{3}{4}\,\mathbf{a_3}$	$=$	$-by_3\,\hat{\mathbf{y}} + \tfrac{3}{4}c\,\hat{\mathbf{z}}$	(4c)	O III
$\mathbf{B_7}$	$=$	$-y_4\,\mathbf{a_1} + y_4\,\mathbf{a_2} + z_4\,\mathbf{a_3}$	$=$	$by_4\,\hat{\mathbf{y}} + cz_4\,\hat{\mathbf{z}}$	(8f)	Nb I
$\mathbf{B_8}$	$=$	$y_4\,\mathbf{a_1} - y_4\,\mathbf{a_2} + \left(z_4 + \tfrac{1}{2}\right)\,\mathbf{a_3}$	$=$	$-by_4\,\hat{\mathbf{y}} + c\left(z_4 + \tfrac{1}{2}\right)\,\hat{\mathbf{z}}$	(8f)	Nb I
$\mathbf{B_9}$	$=$	$-y_4\,\mathbf{a_1} + y_4\,\mathbf{a_2} - \left(z_4 - \tfrac{1}{2}\right)\,\mathbf{a_3}$	$=$	$by_4\,\hat{\mathbf{y}} - c\left(z_4 - \tfrac{1}{2}\right)\,\hat{\mathbf{z}}$	(8f)	Nb I
$\mathbf{B_{10}}$	$=$	$y_4\,\mathbf{a_1} - y_4\,\mathbf{a_2} - z_4\,\mathbf{a_3}$	$=$	$-by_4\,\hat{\mathbf{y}} - cz_4\,\hat{\mathbf{z}}$	(8f)	Nb I
$\mathbf{B_{11}}$	$=$	$-y_5\,\mathbf{a_1} + y_5\,\mathbf{a_2} + z_5\,\mathbf{a_3}$	$=$	$by_5\,\hat{\mathbf{y}} + cz_5\,\hat{\mathbf{z}}$	(8f)	Nb II
$\mathbf{B_{12}}$	$=$	$y_5\,\mathbf{a_1} - y_5\,\mathbf{a_2} + \left(z_5 + \tfrac{1}{2}\right)\,\mathbf{a_3}$	$=$	$-by_5\,\hat{\mathbf{y}} + c\left(z_5 + \tfrac{1}{2}\right)\,\hat{\mathbf{z}}$	(8f)	Nb II
$\mathbf{B_{13}}$	$=$	$-y_5\,\mathbf{a_1} + y_5\,\mathbf{a_2} - \left(z_5 - \tfrac{1}{2}\right)\,\mathbf{a_3}$	$=$	$by_5\,\hat{\mathbf{y}} - c\left(z_5 - \tfrac{1}{2}\right)\,\hat{\mathbf{z}}$	(8f)	Nb II

$$\mathbf{B_{14}} = y_5\,\mathbf{a}_1 - y_5\,\mathbf{a}_2 - z_5\,\mathbf{a}_3 = -by_5\,\hat{\mathbf{y}} - cz_5\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{Nb II}$$

$$\mathbf{B_{15}} = -y_6\,\mathbf{a}_1 + y_6\,\mathbf{a}_2 + z_6\,\mathbf{a}_3 = by_6\,\hat{\mathbf{y}} + cz_6\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{Nb III}$$

$$\mathbf{B_{16}} = y_6\,\mathbf{a}_1 - y_6\,\mathbf{a}_2 + \left(z_6 + \tfrac{1}{2}\right)\mathbf{a}_3 = -by_6\,\hat{\mathbf{y}} + c\left(z_6 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{Nb III}$$

$$\mathbf{B_{17}} = -y_6\,\mathbf{a}_1 + y_6\,\mathbf{a}_2 - \left(z_6 - \tfrac{1}{2}\right)\mathbf{a}_3 = by_6\,\hat{\mathbf{y}} - c\left(z_6 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{Nb III}$$

$$\mathbf{B_{18}} = y_6\,\mathbf{a}_1 - y_6\,\mathbf{a}_2 - z_6\,\mathbf{a}_3 = -by_6\,\hat{\mathbf{y}} - cz_6\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{Nb III}$$

$$\mathbf{B_{19}} = -y_7\,\mathbf{a}_1 + y_7\,\mathbf{a}_2 + z_7\,\mathbf{a}_3 = by_7\,\hat{\mathbf{y}} + cz_7\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{Nb IV}$$

$$\mathbf{B_{20}} = y_7\,\mathbf{a}_1 - y_7\,\mathbf{a}_2 + \left(z_7 + \tfrac{1}{2}\right)\mathbf{a}_3 = -by_7\,\hat{\mathbf{y}} + c\left(z_7 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{Nb IV}$$

$$\mathbf{B_{21}} = -y_7\,\mathbf{a}_1 + y_7\,\mathbf{a}_2 - \left(z_7 - \tfrac{1}{2}\right)\mathbf{a}_3 = by_7\,\hat{\mathbf{y}} - c\left(z_7 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{Nb IV}$$

$$\mathbf{B_{22}} = y_7\,\mathbf{a}_1 - y_7\,\mathbf{a}_2 - z_7\,\mathbf{a}_3 = -by_7\,\hat{\mathbf{y}} - cz_7\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{Nb IV}$$

$$\mathbf{B_{23}} = -y_8\,\mathbf{a}_1 + y_8\,\mathbf{a}_2 + z_8\,\mathbf{a}_3 = by_8\,\hat{\mathbf{y}} + cz_8\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{Nb V}$$

$$\mathbf{B_{24}} = y_8\,\mathbf{a}_1 - y_8\,\mathbf{a}_2 + \left(z_8 + \tfrac{1}{2}\right)\mathbf{a}_3 = -by_8\,\hat{\mathbf{y}} + c\left(z_8 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{Nb V}$$

$$\mathbf{B_{25}} = -y_8\,\mathbf{a}_1 + y_8\,\mathbf{a}_2 - \left(z_8 - \tfrac{1}{2}\right)\mathbf{a}_3 = by_8\,\hat{\mathbf{y}} - c\left(z_8 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{Nb V}$$

$$\mathbf{B_{26}} = y_8\,\mathbf{a}_1 - y_8\,\mathbf{a}_2 - z_8\,\mathbf{a}_3 = -by_8\,\hat{\mathbf{y}} - cz_8\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{Nb V}$$

$$\mathbf{B_{27}} = -y_9\,\mathbf{a}_1 + y_9\,\mathbf{a}_2 + z_9\,\mathbf{a}_3 = by_9\,\hat{\mathbf{y}} + cz_9\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{Nb VI}$$

$$\mathbf{B_{28}} = y_9\,\mathbf{a}_1 - y_9\,\mathbf{a}_2 + \left(z_9 + \tfrac{1}{2}\right)\mathbf{a}_3 = -by_9\,\hat{\mathbf{y}} + c\left(z_9 + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{Nb VI}$$

$$\mathbf{B_{29}} = -y_9\,\mathbf{a}_1 + y_9\,\mathbf{a}_2 - \left(z_9 - \tfrac{1}{2}\right)\mathbf{a}_3 = by_9\,\hat{\mathbf{y}} - c\left(z_9 - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{Nb VI}$$

$$\mathbf{B_{30}} = y_9\,\mathbf{a}_1 - y_9\,\mathbf{a}_2 - z_9\,\mathbf{a}_3 = -by_9\,\hat{\mathbf{y}} - cz_9\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{Nb VI}$$

$$\mathbf{B_{31}} = -y_{10}\,\mathbf{a}_1 + y_{10}\,\mathbf{a}_2 + z_{10}\,\mathbf{a}_3 = by_{10}\,\hat{\mathbf{y}} + cz_{10}\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O IV}$$

$$\mathbf{B_{32}} = y_{10}\,\mathbf{a}_1 - y_{10}\,\mathbf{a}_2 + \left(z_{10} + \tfrac{1}{2}\right)\mathbf{a}_3 = -by_{10}\,\hat{\mathbf{y}} + c\left(z_{10} + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O IV}$$

$$\mathbf{B_{33}} = -y_{10}\,\mathbf{a}_1 + y_{10}\,\mathbf{a}_2 - \left(z_{10} - \tfrac{1}{2}\right)\mathbf{a}_3 = by_{10}\,\hat{\mathbf{y}} - c\left(z_{10} - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O IV}$$

$$\mathbf{B_{34}} = y_{10}\,\mathbf{a}_1 - y_{10}\,\mathbf{a}_2 - z_{10}\,\mathbf{a}_3 = -by_{10}\,\hat{\mathbf{y}} - cz_{10}\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O IV}$$

$$\mathbf{B_{35}} = -y_{11}\,\mathbf{a}_1 + y_{11}\,\mathbf{a}_2 + z_{11}\,\mathbf{a}_3 = by_{11}\,\hat{\mathbf{y}} + cz_{11}\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O V}$$

$$\mathbf{B_{36}} = y_{11}\,\mathbf{a}_1 - y_{11}\,\mathbf{a}_2 + \left(z_{11} + \tfrac{1}{2}\right)\mathbf{a}_3 = -by_{11}\,\hat{\mathbf{y}} + c\left(z_{11} + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O V}$$

$$\mathbf{B_{37}} = -y_{11}\,\mathbf{a}_1 + y_{11}\,\mathbf{a}_2 - \left(z_{11} - \tfrac{1}{2}\right)\mathbf{a}_3 = by_{11}\,\hat{\mathbf{y}} - c\left(z_{11} - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O V}$$

$$\mathbf{B_{38}} = y_{11}\,\mathbf{a}_1 - y_{11}\,\mathbf{a}_2 - z_{11}\,\mathbf{a}_3 = -by_{11}\,\hat{\mathbf{y}} - cz_{11}\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O V}$$

$$\mathbf{B_{39}} = -y_{12}\,\mathbf{a}_1 + y_{12}\,\mathbf{a}_2 + z_{12}\,\mathbf{a}_3 = by_{12}\,\hat{\mathbf{y}} + cz_{12}\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O VI}$$

$$\mathbf{B_{40}} = y_{12}\,\mathbf{a}_1 - y_{12}\,\mathbf{a}_2 + \left(z_{12} + \tfrac{1}{2}\right)\mathbf{a}_3 = -by_{12}\,\hat{\mathbf{y}} + c\left(z_{12} + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O VI}$$

$$\mathbf{B_{41}} = -y_{12}\,\mathbf{a}_1 + y_{12}\,\mathbf{a}_2 - \left(z_{12} - \tfrac{1}{2}\right)\mathbf{a}_3 = by_{12}\,\hat{\mathbf{y}} - c\left(z_{12} - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O VI}$$

$$\mathbf{B_{42}} = y_{12}\,\mathbf{a}_1 - y_{12}\,\mathbf{a}_2 - z_{12}\,\mathbf{a}_3 = -by_{12}\,\hat{\mathbf{y}} - cz_{12}\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O VI}$$

$$\mathbf{B_{43}} = -y_{13}\,\mathbf{a}_1 + y_{13}\,\mathbf{a}_2 + z_{13}\,\mathbf{a}_3 = by_{13}\,\hat{\mathbf{y}} + cz_{13}\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O VII}$$

$$\mathbf{B_{44}} = y_{13}\,\mathbf{a}_1 - y_{13}\,\mathbf{a}_2 + \left(z_{13} + \tfrac{1}{2}\right)\mathbf{a}_3 = -by_{13}\,\hat{\mathbf{y}} + c\left(z_{13} + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O VII}$$

$$\mathbf{B_{45}} = -y_{13}\,\mathbf{a}_1 + y_{13}\,\mathbf{a}_2 - \left(z_{13} - \tfrac{1}{2}\right)\mathbf{a}_3 = by_{13}\,\hat{\mathbf{y}} - c\left(z_{13} - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O VII}$$

$$\mathbf{B_{46}} = y_{13}\,\mathbf{a}_1 - y_{13}\,\mathbf{a}_2 - z_{13}\,\mathbf{a}_3 = -by_{13}\,\hat{\mathbf{y}} - cz_{13}\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O VII}$$

$$\mathbf{B_{47}} = -y_{14}\,\mathbf{a}_1 + y_{14}\,\mathbf{a}_2 + z_{14}\,\mathbf{a}_3 = by_{14}\,\hat{\mathbf{y}} + cz_{14}\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O VIII}$$

$$\mathbf{B_{48}} = y_{14}\,\mathbf{a}_1 - y_{14}\,\mathbf{a}_2 + \left(z_{14} + \tfrac{1}{2}\right)\mathbf{a}_3 = -by_{14}\,\hat{\mathbf{y}} + c\left(z_{14} + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O VIII}$$

$$\mathbf{B_{49}} = -y_{14}\,\mathbf{a}_1 + y_{14}\,\mathbf{a}_2 - \left(z_{14} - \tfrac{1}{2}\right)\mathbf{a}_3 = by_{14}\,\hat{\mathbf{y}} - c\left(z_{14} - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O VIII}$$

$$\mathbf{B_{50}} = y_{14}\,\mathbf{a}_1 - y_{14}\,\mathbf{a}_2 - z_{14}\,\mathbf{a}_3 = -by_{14}\,\hat{\mathbf{y}} - cz_{14}\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O VIII}$$

$$\mathbf{B_{51}} = -y_{15}\,\mathbf{a}_1 + y_{15}\,\mathbf{a}_2 + z_{15}\,\mathbf{a}_3 = by_{15}\,\hat{\mathbf{y}} + cz_{15}\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O IX}$$

$$\mathbf{B_{52}} = y_{15}\,\mathbf{a}_1 - y_{15}\,\mathbf{a}_2 + \left(z_{15} + \tfrac{1}{2}\right)\mathbf{a}_3 = -by_{15}\,\hat{\mathbf{y}} + c\left(z_{15} + \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O IX}$$

$$\mathbf{B_{53}} = -y_{15}\,\mathbf{a}_1 + y_{15}\,\mathbf{a}_2 - \left(z_{15} - \tfrac{1}{2}\right)\mathbf{a}_3 = by_{15}\,\hat{\mathbf{y}} - c\left(z_{15} - \tfrac{1}{2}\right)\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O IX}$$

$$\mathbf{B_{54}} = y_{15}\,\mathbf{a}_1 - y_{15}\,\mathbf{a}_2 - z_{15}\,\mathbf{a}_3 = -by_{15}\,\hat{\mathbf{y}} - cz_{15}\,\hat{\mathbf{z}} \qquad \text{(8f)} \qquad \text{O IX}$$

$\mathbf{B_{55}}$	$=$	$-y_{16}\,\mathbf{a}_1 + y_{16}\,\mathbf{a}_2 + z_{16}\,\mathbf{a}_3$	$=$	$by_{16}\,\hat{\mathbf{y}} + cz_{16}\,\hat{\mathbf{z}}$	(8f)	O X
$\mathbf{B_{56}}$	$=$	$y_{16}\,\mathbf{a}_1 - y_{16}\,\mathbf{a}_2 + \left(z_{16}+\tfrac{1}{2}\right)\mathbf{a}_3$	$=$	$-by_{16}\,\hat{\mathbf{y}} + c\left(z_{16}+\tfrac{1}{2}\right)\hat{\mathbf{z}}$	(8f)	O X
$\mathbf{B_{57}}$	$=$	$-y_{16}\,\mathbf{a}_1 + y_{16}\,\mathbf{a}_2 - \left(z_{16}-\tfrac{1}{2}\right)\mathbf{a}_3$	$=$	$by_{16}\,\hat{\mathbf{y}} - c\left(z_{16}-\tfrac{1}{2}\right)\hat{\mathbf{z}}$	(8f)	O X
$\mathbf{B_{58}}$	$=$	$y_{16}\,\mathbf{a}_1 - y_{16}\,\mathbf{a}_2 - z_{16}\,\mathbf{a}_3$	$=$	$-by_{16}\,\hat{\mathbf{y}} - cz_{16}\,\hat{\mathbf{z}}$	(8f)	O X
$\mathbf{B_{59}}$	$=$	$-y_{17}\,\mathbf{a}_1 + y_{17}\,\mathbf{a}_2 + z_{17}\,\mathbf{a}_3$	$=$	$by_{17}\,\hat{\mathbf{y}} + cz_{17}\,\hat{\mathbf{z}}$	(8f)	O XI
$\mathbf{B_{60}}$	$=$	$y_{17}\,\mathbf{a}_1 - y_{17}\,\mathbf{a}_2 + \left(z_{17}+\tfrac{1}{2}\right)\mathbf{a}_3$	$=$	$-by_{17}\,\hat{\mathbf{y}} + c\left(z_{17}+\tfrac{1}{2}\right)\hat{\mathbf{z}}$	(8f)	O XI
$\mathbf{B_{61}}$	$=$	$-y_{17}\,\mathbf{a}_1 + y_{17}\,\mathbf{a}_2 - \left(z_{17}-\tfrac{1}{2}\right)\mathbf{a}_3$	$=$	$by_{17}\,\hat{\mathbf{y}} - c\left(z_{17}-\tfrac{1}{2}\right)\hat{\mathbf{z}}$	(8f)	O XI
$\mathbf{B_{62}}$	$=$	$y_{17}\,\mathbf{a}_1 - y_{17}\,\mathbf{a}_2 - z_{17}\,\mathbf{a}_3$	$=$	$-by_{17}\,\hat{\mathbf{y}} - cz_{17}\,\hat{\mathbf{z}}$	(8f)	O XI
$\mathbf{B_{63}}$	$=$	$-y_{18}\,\mathbf{a}_1 + y_{18}\,\mathbf{a}_2 + z_{18}\,\mathbf{a}_3$	$=$	$by_{18}\,\hat{\mathbf{y}} + cz_{18}\,\hat{\mathbf{z}}$	(8f)	O XII
$\mathbf{B_{64}}$	$=$	$y_{18}\,\mathbf{a}_1 - y_{18}\,\mathbf{a}_2 + \left(z_{18}+\tfrac{1}{2}\right)\mathbf{a}_3$	$=$	$-by_{18}\,\hat{\mathbf{y}} + c\left(z_{18}+\tfrac{1}{2}\right)\hat{\mathbf{z}}$	(8f)	O XII
$\mathbf{B_{65}}$	$=$	$-y_{18}\,\mathbf{a}_1 + y_{18}\,\mathbf{a}_2 - \left(z_{18}-\tfrac{1}{2}\right)\mathbf{a}_3$	$=$	$by_{18}\,\hat{\mathbf{y}} - c\left(z_{18}-\tfrac{1}{2}\right)\hat{\mathbf{z}}$	(8f)	O XII
$\mathbf{B_{66}}$	$=$	$y_{18}\,\mathbf{a}_1 - y_{18}\,\mathbf{a}_2 - z_{18}\,\mathbf{a}_3$	$=$	$-by_{18}\,\hat{\mathbf{y}} - cz_{18}\,\hat{\mathbf{z}}$	(8f)	O XII
$\mathbf{B_{67}}$	$=$	$-y_{19}\,\mathbf{a}_1 + y_{19}\,\mathbf{a}_2 + z_{19}\,\mathbf{a}_3$	$=$	$by_{19}\,\hat{\mathbf{y}} + cz_{19}\,\hat{\mathbf{z}}$	(8f)	O XIII
$\mathbf{B_{68}}$	$=$	$y_{19}\,\mathbf{a}_1 - y_{19}\,\mathbf{a}_2 + \left(z_{19}+\tfrac{1}{2}\right)\mathbf{a}_3$	$=$	$-by_{19}\,\hat{\mathbf{y}} + c\left(z_{19}+\tfrac{1}{2}\right)\hat{\mathbf{z}}$	(8f)	O XIII
$\mathbf{B_{69}}$	$=$	$-y_{19}\,\mathbf{a}_1 + y_{19}\,\mathbf{a}_2 - \left(z_{19}-\tfrac{1}{2}\right)\mathbf{a}_3$	$=$	$by_{19}\,\hat{\mathbf{y}} - c\left(z_{19}-\tfrac{1}{2}\right)\hat{\mathbf{z}}$	(8f)	O XIII
$\mathbf{B_{70}}$	$=$	$y_{19}\,\mathbf{a}_1 - y_{19}\,\mathbf{a}_2 - z_{19}\,\mathbf{a}_3$	$=$	$-by_{19}\,\hat{\mathbf{y}} - cz_{19}\,\hat{\mathbf{z}}$	(8f)	O XIII
$\mathbf{B_{71}}$	$=$	$-y_{20}\,\mathbf{a}_1 + y_{20}\,\mathbf{a}_2 + z_{20}\,\mathbf{a}_3$	$=$	$by_{20}\,\hat{\mathbf{y}} + cz_{20}\,\hat{\mathbf{z}}$	(8f)	O XIV
$\mathbf{B_{72}}$	$=$	$y_{20}\,\mathbf{a}_1 - y_{20}\,\mathbf{a}_2 + \left(z_{20}+\tfrac{1}{2}\right)\mathbf{a}_3$	$=$	$-by_{20}\,\hat{\mathbf{y}} + c\left(z_{20}+\tfrac{1}{2}\right)\hat{\mathbf{z}}$	(8f)	O XIV
$\mathbf{B_{73}}$	$=$	$-y_{20}\,\mathbf{a}_1 + y_{20}\,\mathbf{a}_2 - \left(z_{20}-\tfrac{1}{2}\right)\mathbf{a}_3$	$=$	$by_{20}\,\hat{\mathbf{y}} - c\left(z_{20}-\tfrac{1}{2}\right)\hat{\mathbf{z}}$	(8f)	O XIV
$\mathbf{B_{74}}$	$=$	$y_{20}\,\mathbf{a}_1 - y_{20}\,\mathbf{a}_2 - z_{20}\,\mathbf{a}_3$	$=$	$-by_{20}\,\hat{\mathbf{y}} - cz_{20}\,\hat{\mathbf{z}}$	(8f)	O XIV
$\mathbf{B_{75}}$	$=$	$-y_{21}\,\mathbf{a}_1 + y_{21}\,\mathbf{a}_2 + z_{21}\,\mathbf{a}_3$	$=$	$by_{21}\,\hat{\mathbf{y}} + cz_{21}\,\hat{\mathbf{z}}$	(8f)	O XV
$\mathbf{B_{76}}$	$=$	$y_{21}\,\mathbf{a}_1 - y_{21}\,\mathbf{a}_2 + \left(z_{21}+\tfrac{1}{2}\right)\mathbf{a}_3$	$=$	$-by_{21}\,\hat{\mathbf{y}} + c\left(z_{21}+\tfrac{1}{2}\right)\hat{\mathbf{z}}$	(8f)	O XV
$\mathbf{B_{77}}$	$=$	$-y_{21}\,\mathbf{a}_1 + y_{21}\,\mathbf{a}_2 - \left(z_{21}-\tfrac{1}{2}\right)\mathbf{a}_3$	$=$	$by_{21}\,\hat{\mathbf{y}} - c\left(z_{21}-\tfrac{1}{2}\right)\hat{\mathbf{z}}$	(8f)	O XV
$\mathbf{B_{78}}$	$=$	$y_{21}\,\mathbf{a}_1 - y_{21}\,\mathbf{a}_2 - z_{21}\,\mathbf{a}_3$	$=$	$-by_{21}\,\hat{\mathbf{y}} - cz_{21}\,\hat{\mathbf{z}}$	(8f)	O XV
$\mathbf{B_{79}}$	$=$	$-y_{22}\,\mathbf{a}_1 + y_{22}\,\mathbf{a}_2 + z_{22}\,\mathbf{a}_3$	$=$	$by_{22}\,\hat{\mathbf{y}} + cz_{22}\,\hat{\mathbf{z}}$	(8f)	O XVI
$\mathbf{B_{80}}$	$=$	$y_{22}\,\mathbf{a}_1 - y_{22}\,\mathbf{a}_2 + \left(z_{22}+\tfrac{1}{2}\right)\mathbf{a}_3$	$=$	$-by_{22}\,\hat{\mathbf{y}} + c\left(z_{22}+\tfrac{1}{2}\right)\hat{\mathbf{z}}$	(8f)	O XVI
$\mathbf{B_{81}}$	$=$	$-y_{22}\,\mathbf{a}_1 + y_{22}\,\mathbf{a}_2 - \left(z_{22}-\tfrac{1}{2}\right)\mathbf{a}_3$	$=$	$by_{22}\,\hat{\mathbf{y}} - c\left(z_{22}-\tfrac{1}{2}\right)\hat{\mathbf{z}}$	(8f)	O XVI
$\mathbf{B_{82}}$	$=$	$y_{22}\,\mathbf{a}_1 - y_{22}\,\mathbf{a}_2 - z_{22}\,\mathbf{a}_3$	$=$	$-by_{22}\,\hat{\mathbf{y}} - cz_{22}\,\hat{\mathbf{z}}$	(8f)	O XVI

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