β-Arabinose $(CO_2H)_{20}$ Structure: AB2C_oP80_19_5a_10a_5a-001

This structure originally had the label `AB2C_oP80_19_5a_10a_5a`. Calls to that address will be redirected here.

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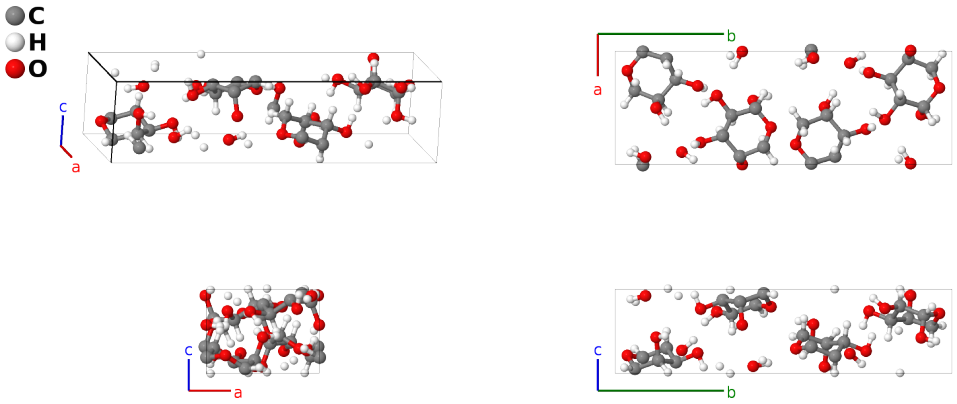
https://aflow.org/p/K9SN

https://aflow.org/p/AB2C_oP80_19_5a_10a_5a-001

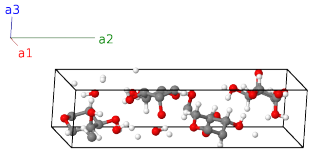


Prototype	CH_2O
AFLOW prototype label	AB2C_oP80_19_5a_10a_5a-001
Mineral name	arabinose
CCDC	1100220
Pearson symbol	oP80
Space group number	19
Space group symbol	$P2_12_12_1$
AFLOW prototype command	`aflow --proto=AB2C_oP80_19_5a_10a_5a-001 --params=`$a, b/a, c/a, x_1, y_1, z_1, x_2, y_2, z_2, x_3, y_3, z_3, x_4, y_4, z_4, x_5, y_5, z_5, x_6, y_6, z_6, x_7, y_7, z_7, x_8, y_8, z_8, x_9, y_9, z_9, x_{10}, y_{10}, z_{10}, x_{11}, y_{11}, z_{11}, x_{12}, y_{12}, z_{12}, x_{13}, y_{13}, z_{13}, x_{14}, y_{14}, z_{14}, x_{15}, y_{15}, z_{15}, x_{16}, y_{16}, z_{16}, x_{17}, y_{17}, z_{17}, x_{18}, y_{18}, z_{18}, x_{19}, y_{19}, z_{19}, x_{20}, y_{20}, z_{20}$

- The CIF provided by the CCDC uses a non-standard setting of space group $P2_12_12_1$ #19, but uses the coordinates provided by (Hordvick, 1961). This produces a somewhat different structure than we present. We find no evidence that (Hordvick, 1961) used a non-standard setting, and our interatomic distances agree with the published numbers, so we will use the standard setting.

Simple Orthorhombic primitive vectors

$$\mathbf{a_1} = a\,\hat{\mathbf{x}}$$
$$\mathbf{a_2} = b\,\hat{\mathbf{y}}$$
$$\mathbf{a_3} = c\,\hat{\mathbf{z}}$$



Basis vectors

		Lattice coordinates		Cartesian coordinates	Wyckoff position	Atom type
$\mathbf{B_1}$	=	$x_1\,\mathbf{a}_1 + y_1\,\mathbf{a}_2 + z_1\,\mathbf{a}_3$	=	$ax_1\,\hat{\mathbf{x}} + by_1\,\hat{\mathbf{y}} + cz_1\,\hat{\mathbf{z}}$	(4a)	C I
$\mathbf{B_2}$	=	$-\left(x_1-\frac{1}{2}\right)\,\mathbf{a}_1 - y_1\,\mathbf{a}_2 + \left(z_1+\frac{1}{2}\right)\,\mathbf{a}_3$	=	$-a\left(x_1-\frac{1}{2}\right)\,\hat{\mathbf{x}} - by_1\,\hat{\mathbf{y}} + c\left(z_1+\frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	C I
$\mathbf{B_3}$	=	$-x_1\,\mathbf{a}_1 + \left(y_1+\frac{1}{2}\right)\,\mathbf{a}_2 - \left(z_1-\frac{1}{2}\right)\,\mathbf{a}_3$	=	$-ax_1\,\hat{\mathbf{x}} + b\left(y_1+\frac{1}{2}\right)\,\hat{\mathbf{y}} - c\left(z_1-\frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	C I
$\mathbf{B_4}$	=	$\left(x_1+\frac{1}{2}\right)\,\mathbf{a}_1 - \left(y_1-\frac{1}{2}\right)\,\mathbf{a}_2 - z_1\,\mathbf{a}_3$	=	$a\left(x_1+\frac{1}{2}\right)\,\hat{\mathbf{x}} - b\left(y_1-\frac{1}{2}\right)\,\hat{\mathbf{y}} - cz_1\,\hat{\mathbf{z}}$	(4a)	C I
$\mathbf{B_5}$	=	$x_2\,\mathbf{a}_1 + y_2\,\mathbf{a}_2 + z_2\,\mathbf{a}_3$	=	$ax_2\,\hat{\mathbf{x}} + by_2\,\hat{\mathbf{y}} + cz_2\,\hat{\mathbf{z}}$	(4a)	C II
$\mathbf{B_6}$	=	$-\left(x_2-\frac{1}{2}\right)\,\mathbf{a}_1 - y_2\,\mathbf{a}_2 + \left(z_2+\frac{1}{2}\right)\,\mathbf{a}_3$	=	$-a\left(x_2-\frac{1}{2}\right)\,\hat{\mathbf{x}} - by_2\,\hat{\mathbf{y}} + c\left(z_2+\frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	C II
$\mathbf{B_7}$	=	$-x_2\,\mathbf{a}_1 + \left(y_2+\frac{1}{2}\right)\,\mathbf{a}_2 - \left(z_2-\frac{1}{2}\right)\,\mathbf{a}_3$	=	$-ax_2\,\hat{\mathbf{x}} + b\left(y_2+\frac{1}{2}\right)\,\hat{\mathbf{y}} - c\left(z_2-\frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	C II
$\mathbf{B_8}$	=	$\left(x_2+\frac{1}{2}\right)\,\mathbf{a}_1 - \left(y_2-\frac{1}{2}\right)\,\mathbf{a}_2 - z_2\,\mathbf{a}_3$	=	$a\left(x_2+\frac{1}{2}\right)\,\hat{\mathbf{x}} - b\left(y_2-\frac{1}{2}\right)\,\hat{\mathbf{y}} - cz_2\,\hat{\mathbf{z}}$	(4a)	C II
$\mathbf{B_9}$	=	$x_3\,\mathbf{a}_1 + y_3\,\mathbf{a}_2 + z_3\,\mathbf{a}_3$	=	$ax_3\,\hat{\mathbf{x}} + by_3\,\hat{\mathbf{y}} + cz_3\,\hat{\mathbf{z}}$	(4a)	C III
$\mathbf{B_{10}}$	=	$-\left(x_3-\frac{1}{2}\right)\,\mathbf{a}_1 - y_3\,\mathbf{a}_2 + \left(z_3+\frac{1}{2}\right)\,\mathbf{a}_3$	=	$-a\left(x_3-\frac{1}{2}\right)\,\hat{\mathbf{x}} - by_3\,\hat{\mathbf{y}} + c\left(z_3+\frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	C III
$\mathbf{B_{11}}$	=	$-x_3\,\mathbf{a}_1 + \left(y_3+\frac{1}{2}\right)\,\mathbf{a}_2 - \left(z_3-\frac{1}{2}\right)\,\mathbf{a}_3$	=	$-ax_3\,\hat{\mathbf{x}} + b\left(y_3+\frac{1}{2}\right)\,\hat{\mathbf{y}} - c\left(z_3-\frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	C III
$\mathbf{B_{12}}$	=	$\left(x_3+\frac{1}{2}\right)\,\mathbf{a}_1 - \left(y_3-\frac{1}{2}\right)\,\mathbf{a}_2 - z_3\,\mathbf{a}_3$	=	$a\left(x_3+\frac{1}{2}\right)\,\hat{\mathbf{x}} - b\left(y_3-\frac{1}{2}\right)\,\hat{\mathbf{y}} - cz_3\,\hat{\mathbf{z}}$	(4a)	C III
$\mathbf{B_{13}}$	=	$x_4\,\mathbf{a}_1 + y_4\,\mathbf{a}_2 + z_4\,\mathbf{a}_3$	=	$ax_4\,\hat{\mathbf{x}} + by_4\,\hat{\mathbf{y}} + cz_4\,\hat{\mathbf{z}}$	(4a)	C IV
$\mathbf{B_{14}}$	=	$-\left(x_4-\frac{1}{2}\right)\,\mathbf{a}_1 - y_4\,\mathbf{a}_2 + \left(z_4+\frac{1}{2}\right)\,\mathbf{a}_3$	=	$-a\left(x_4-\frac{1}{2}\right)\,\hat{\mathbf{x}} - by_4\,\hat{\mathbf{y}} + c\left(z_4+\frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	C IV
$\mathbf{B_{15}}$	=	$-x_4\,\mathbf{a}_1 + \left(y_4+\frac{1}{2}\right)\,\mathbf{a}_2 - \left(z_4-\frac{1}{2}\right)\,\mathbf{a}_3$	=	$-ax_4\,\hat{\mathbf{x}} + b\left(y_4+\frac{1}{2}\right)\,\hat{\mathbf{y}} - c\left(z_4-\frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	C IV
$\mathbf{B_{16}}$	=	$\left(x_4+\frac{1}{2}\right)\,\mathbf{a}_1 - \left(y_4-\frac{1}{2}\right)\,\mathbf{a}_2 - z_4\,\mathbf{a}_3$	=	$a\left(x_4+\frac{1}{2}\right)\,\hat{\mathbf{x}} - b\left(y_4-\frac{1}{2}\right)\,\hat{\mathbf{y}} - cz_4\,\hat{\mathbf{z}}$	(4a)	C IV
$\mathbf{B_{17}}$	=	$x_5\,\mathbf{a}_1 + y_5\,\mathbf{a}_2 + z_5\,\mathbf{a}_3$	=	$ax_5\,\hat{\mathbf{x}} + by_5\,\hat{\mathbf{y}} + cz_5\,\hat{\mathbf{z}}$	(4a)	C V
$\mathbf{B_{18}}$	=	$-\left(x_5-\frac{1}{2}\right)\,\mathbf{a}_1 - y_5\,\mathbf{a}_2 + \left(z_5+\frac{1}{2}\right)\,\mathbf{a}_3$	=	$-a\left(x_5-\frac{1}{2}\right)\,\hat{\mathbf{x}} - by_5\,\hat{\mathbf{y}} + c\left(z_5+\frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	C V
$\mathbf{B_{19}}$	=	$-x_5\,\mathbf{a}_1 + \left(y_5+\frac{1}{2}\right)\,\mathbf{a}_2 - \left(z_5-\frac{1}{2}\right)\,\mathbf{a}_3$	=	$-ax_5\,\hat{\mathbf{x}} + b\left(y_5+\frac{1}{2}\right)\,\hat{\mathbf{y}} - c\left(z_5-\frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	C V
$\mathbf{B_{20}}$	=	$\left(x_5+\frac{1}{2}\right)\,\mathbf{a}_1 - \left(y_5-\frac{1}{2}\right)\,\mathbf{a}_2 - z_5\,\mathbf{a}_3$	=	$a\left(x_5+\frac{1}{2}\right)\,\hat{\mathbf{x}} - b\left(y_5-\frac{1}{2}\right)\,\hat{\mathbf{y}} - cz_5\,\hat{\mathbf{z}}$	(4a)	C V
$\mathbf{B_{21}}$	=	$x_6\,\mathbf{a}_1 + y_6\,\mathbf{a}_2 + z_6\,\mathbf{a}_3$	=	$ax_6\,\hat{\mathbf{x}} + by_6\,\hat{\mathbf{y}} + cz_6\,\hat{\mathbf{z}}$	(4a)	H I
$\mathbf{B_{22}}$	=	$-\left(x_6-\frac{1}{2}\right)\,\mathbf{a}_1 - y_6\,\mathbf{a}_2 + \left(z_6+\frac{1}{2}\right)\,\mathbf{a}_3$	=	$-a\left(x_6-\frac{1}{2}\right)\,\hat{\mathbf{x}} - by_6\,\hat{\mathbf{y}} + c\left(z_6+\frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	H I
$\mathbf{B_{23}}$	=	$-x_6\,\mathbf{a}_1 + \left(y_6+\frac{1}{2}\right)\,\mathbf{a}_2 - \left(z_6-\frac{1}{2}\right)\,\mathbf{a}_3$	=	$-ax_6\,\hat{\mathbf{x}} + b\left(y_6+\frac{1}{2}\right)\,\hat{\mathbf{y}} - c\left(z_6-\frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	H I
$\mathbf{B_{24}}$	=	$\left(x_6+\frac{1}{2}\right)\,\mathbf{a}_1 - \left(y_6-\frac{1}{2}\right)\,\mathbf{a}_2 - z_6\,\mathbf{a}_3$	=	$a\left(x_6+\frac{1}{2}\right)\,\hat{\mathbf{x}} - b\left(y_6-\frac{1}{2}\right)\,\hat{\mathbf{y}} - cz_6\,\hat{\mathbf{z}}$	(4a)	H I

$\mathbf{B_{25}}$	$=$	$x_7\,\mathbf{a}_1 + y_7\,\mathbf{a}_2 + z_7\,\mathbf{a}_3$	$=$	$ax_7\,\hat{\mathbf{x}} + by_7\,\hat{\mathbf{y}} + cz_7\,\hat{\mathbf{z}}$	(4a)	H II
$\mathbf{B_{26}}$	$=$	$-\left(x_7 - \frac{1}{2}\right)\,\mathbf{a}_1 - y_7\,\mathbf{a}_2 + \left(z_7 + \frac{1}{2}\right)\,\mathbf{a}_3$	$=$	$-a\left(x_7 - \frac{1}{2}\right)\,\hat{\mathbf{x}} - by_7\,\hat{\mathbf{y}} + c\left(z_7 + \frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	H II
$\mathbf{B_{27}}$	$=$	$-x_7\,\mathbf{a}_1 + \left(y_7 + \frac{1}{2}\right)\,\mathbf{a}_2 - \left(z_7 - \frac{1}{2}\right)\,\mathbf{a}_3$	$=$	$-ax_7\,\hat{\mathbf{x}} + b\left(y_7 + \frac{1}{2}\right)\,\hat{\mathbf{y}} - c\left(z_7 - \frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	H II
$\mathbf{B_{28}}$	$=$	$\left(x_7 + \frac{1}{2}\right)\,\mathbf{a}_1 - \left(y_7 - \frac{1}{2}\right)\,\mathbf{a}_2 - z_7\,\mathbf{a}_3$	$=$	$a\left(x_7 + \frac{1}{2}\right)\,\hat{\mathbf{x}} - b\left(y_7 - \frac{1}{2}\right)\,\hat{\mathbf{y}} - cz_7\,\hat{\mathbf{z}}$	(4a)	H II
$\mathbf{B_{29}}$	$=$	$x_8\,\mathbf{a}_1 + y_8\,\mathbf{a}_2 + z_8\,\mathbf{a}_3$	$=$	$ax_8\,\hat{\mathbf{x}} + by_8\,\hat{\mathbf{y}} + cz_8\,\hat{\mathbf{z}}$	(4a)	H III
$\mathbf{B_{30}}$	$=$	$-\left(x_8 - \frac{1}{2}\right)\,\mathbf{a}_1 - y_8\,\mathbf{a}_2 + \left(z_8 + \frac{1}{2}\right)\,\mathbf{a}_3$	$=$	$-a\left(x_8 - \frac{1}{2}\right)\,\hat{\mathbf{x}} - by_8\,\hat{\mathbf{y}} + c\left(z_8 + \frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	H III
$\mathbf{B_{31}}$	$=$	$-x_8\,\mathbf{a}_1 + \left(y_8 + \frac{1}{2}\right)\,\mathbf{a}_2 - \left(z_8 - \frac{1}{2}\right)\,\mathbf{a}_3$	$=$	$-ax_8\,\hat{\mathbf{x}} + b\left(y_8 + \frac{1}{2}\right)\,\hat{\mathbf{y}} - c\left(z_8 - \frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	H III
$\mathbf{B_{32}}$	$=$	$\left(x_8 + \frac{1}{2}\right)\,\mathbf{a}_1 - \left(y_8 - \frac{1}{2}\right)\,\mathbf{a}_2 - z_8\,\mathbf{a}_3$	$=$	$a\left(x_8 + \frac{1}{2}\right)\,\hat{\mathbf{x}} - b\left(y_8 - \frac{1}{2}\right)\,\hat{\mathbf{y}} - cz_8\,\hat{\mathbf{z}}$	(4a)	H III
$\mathbf{B_{33}}$	$=$	$x_9\,\mathbf{a}_1 + y_9\,\mathbf{a}_2 + z_9\,\mathbf{a}_3$	$=$	$ax_9\,\hat{\mathbf{x}} + by_9\,\hat{\mathbf{y}} + cz_9\,\hat{\mathbf{z}}$	(4a)	H IV
$\mathbf{B_{34}}$	$=$	$-\left(x_9 - \frac{1}{2}\right)\,\mathbf{a}_1 - y_9\,\mathbf{a}_2 + \left(z_9 + \frac{1}{2}\right)\,\mathbf{a}_3$	$=$	$-a\left(x_9 - \frac{1}{2}\right)\,\hat{\mathbf{x}} - by_9\,\hat{\mathbf{y}} + c\left(z_9 + \frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	H IV
$\mathbf{B_{35}}$	$=$	$-x_9\,\mathbf{a}_1 + \left(y_9 + \frac{1}{2}\right)\,\mathbf{a}_2 - \left(z_9 - \frac{1}{2}\right)\,\mathbf{a}_3$	$=$	$-ax_9\,\hat{\mathbf{x}} + b\left(y_9 + \frac{1}{2}\right)\,\hat{\mathbf{y}} - c\left(z_9 - \frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	H IV
$\mathbf{B_{36}}$	$=$	$\left(x_9 + \frac{1}{2}\right)\,\mathbf{a}_1 - \left(y_9 - \frac{1}{2}\right)\,\mathbf{a}_2 - z_9\,\mathbf{a}_3$	$=$	$a\left(x_9 + \frac{1}{2}\right)\,\hat{\mathbf{x}} - b\left(y_9 - \frac{1}{2}\right)\,\hat{\mathbf{y}} - cz_9\,\hat{\mathbf{z}}$	(4a)	H IV
$\mathbf{B_{37}}$	$=$	$x_{10}\,\mathbf{a}_1 + y_{10}\,\mathbf{a}_2 + z_{10}\,\mathbf{a}_3$	$=$	$ax_{10}\,\hat{\mathbf{x}} + by_{10}\,\hat{\mathbf{y}} + cz_{10}\,\hat{\mathbf{z}}$	(4a)	H V
$\mathbf{B_{38}}$	$=$	$-\left(x_{10} - \frac{1}{2}\right)\,\mathbf{a}_1 - y_{10}\,\mathbf{a}_2 + \left(z_{10} + \frac{1}{2}\right)\,\mathbf{a}_3$	$=$	$-a\left(x_{10} - \frac{1}{2}\right)\,\hat{\mathbf{x}} - by_{10}\,\hat{\mathbf{y}} + c\left(z_{10} + \frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	H V
$\mathbf{B_{39}}$	$=$	$-x_{10}\,\mathbf{a}_1 + \left(y_{10} + \frac{1}{2}\right)\,\mathbf{a}_2 - \left(z_{10} - \frac{1}{2}\right)\,\mathbf{a}_3$	$=$	$-ax_{10}\,\hat{\mathbf{x}} + b\left(y_{10} + \frac{1}{2}\right)\,\hat{\mathbf{y}} - c\left(z_{10} - \frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	H V
$\mathbf{B_{40}}$	$=$	$\left(x_{10} + \frac{1}{2}\right)\,\mathbf{a}_1 - \left(y_{10} - \frac{1}{2}\right)\,\mathbf{a}_2 - z_{10}\,\mathbf{a}_3$	$=$	$a\left(x_{10} + \frac{1}{2}\right)\,\hat{\mathbf{x}} - b\left(y_{10} - \frac{1}{2}\right)\,\hat{\mathbf{y}} - cz_{10}\,\hat{\mathbf{z}}$	(4a)	H V
$\mathbf{B_{41}}$	$=$	$x_{11}\,\mathbf{a}_1 + y_{11}\,\mathbf{a}_2 + z_{11}\,\mathbf{a}_3$	$=$	$ax_{11}\,\hat{\mathbf{x}} + by_{11}\,\hat{\mathbf{y}} + cz_{11}\,\hat{\mathbf{z}}$	(4a)	H VI
$\mathbf{B_{42}}$	$=$	$-\left(x_{11} - \frac{1}{2}\right)\,\mathbf{a}_1 - y_{11}\,\mathbf{a}_2 + \left(z_{11} + \frac{1}{2}\right)\,\mathbf{a}_3$	$=$	$-a\left(x_{11} - \frac{1}{2}\right)\,\hat{\mathbf{x}} - by_{11}\,\hat{\mathbf{y}} + c\left(z_{11} + \frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	H VI
$\mathbf{B_{43}}$	$=$	$-x_{11}\,\mathbf{a}_1 + \left(y_{11} + \frac{1}{2}\right)\,\mathbf{a}_2 - \left(z_{11} - \frac{1}{2}\right)\,\mathbf{a}_3$	$=$	$-ax_{11}\,\hat{\mathbf{x}} + b\left(y_{11} + \frac{1}{2}\right)\,\hat{\mathbf{y}} - c\left(z_{11} - \frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	H VI
$\mathbf{B_{44}}$	$=$	$\left(x_{11} + \frac{1}{2}\right)\,\mathbf{a}_1 - \left(y_{11} - \frac{1}{2}\right)\,\mathbf{a}_2 - z_{11}\,\mathbf{a}_3$	$=$	$a\left(x_{11} + \frac{1}{2}\right)\,\hat{\mathbf{x}} - b\left(y_{11} - \frac{1}{2}\right)\,\hat{\mathbf{y}} - cz_{11}\,\hat{\mathbf{z}}$	(4a)	H VI
$\mathbf{B_{45}}$	$=$	$x_{12}\,\mathbf{a}_1 + y_{12}\,\mathbf{a}_2 + z_{12}\,\mathbf{a}_3$	$=$	$ax_{12}\,\hat{\mathbf{x}} + by_{12}\,\hat{\mathbf{y}} + cz_{12}\,\hat{\mathbf{z}}$	(4a)	H VII
$\mathbf{B_{46}}$	$=$	$-\left(x_{12} - \frac{1}{2}\right)\,\mathbf{a}_1 - y_{12}\,\mathbf{a}_2 + \left(z_{12} + \frac{1}{2}\right)\,\mathbf{a}_3$	$=$	$-a\left(x_{12} - \frac{1}{2}\right)\,\hat{\mathbf{x}} - by_{12}\,\hat{\mathbf{y}} + c\left(z_{12} + \frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	H VII
$\mathbf{B_{47}}$	$=$	$-x_{12}\,\mathbf{a}_1 + \left(y_{12} + \frac{1}{2}\right)\,\mathbf{a}_2 - \left(z_{12} - \frac{1}{2}\right)\,\mathbf{a}_3$	$=$	$-ax_{12}\,\hat{\mathbf{x}} + b\left(y_{12} + \frac{1}{2}\right)\,\hat{\mathbf{y}} - c\left(z_{12} - \frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	H VII
$\mathbf{B_{48}}$	$=$	$\left(x_{12} + \frac{1}{2}\right)\,\mathbf{a}_1 - \left(y_{12} - \frac{1}{2}\right)\,\mathbf{a}_2 - z_{12}\,\mathbf{a}_3$	$=$	$a\left(x_{12} + \frac{1}{2}\right)\,\hat{\mathbf{x}} - b\left(y_{12} - \frac{1}{2}\right)\,\hat{\mathbf{y}} - cz_{12}\,\hat{\mathbf{z}}$	(4a)	H VII
$\mathbf{B_{49}}$	$=$	$x_{13}\,\mathbf{a}_1 + y_{13}\,\mathbf{a}_2 + z_{13}\,\mathbf{a}_3$	$=$	$ax_{13}\,\hat{\mathbf{x}} + by_{13}\,\hat{\mathbf{y}} + cz_{13}\,\hat{\mathbf{z}}$	(4a)	H VIII
$\mathbf{B_{50}}$	$=$	$-\left(x_{13} - \frac{1}{2}\right)\,\mathbf{a}_1 - y_{13}\,\mathbf{a}_2 + \left(z_{13} + \frac{1}{2}\right)\,\mathbf{a}_3$	$=$	$-a\left(x_{13} - \frac{1}{2}\right)\,\hat{\mathbf{x}} - by_{13}\,\hat{\mathbf{y}} + c\left(z_{13} + \frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	H VIII
$\mathbf{B_{51}}$	$=$	$-x_{13}\,\mathbf{a}_1 + \left(y_{13} + \frac{1}{2}\right)\,\mathbf{a}_2 - \left(z_{13} - \frac{1}{2}\right)\,\mathbf{a}_3$	$=$	$-ax_{13}\,\hat{\mathbf{x}} + b\left(y_{13} + \frac{1}{2}\right)\,\hat{\mathbf{y}} - c\left(z_{13} - \frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	H VIII

$$\mathbf{B_{52}} = \left(x_{13}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_{13}-\tfrac{1}{2}\right)\mathbf{a}_2 - z_{13}\,\mathbf{a}_3 = a\left(x_{13}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - b\left(y_{13}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - cz_{13}\,\hat{\mathbf{z}} \quad (4a) \quad \text{H VIII}$$

$$\mathbf{B_{53}} = x_{14}\,\mathbf{a}_1 + y_{14}\,\mathbf{a}_2 + z_{14}\,\mathbf{a}_3 = ax_{14}\,\hat{\mathbf{x}} + by_{14}\,\hat{\mathbf{y}} + cz_{14}\,\hat{\mathbf{z}} \quad (4a) \quad \text{H IX}$$

$$\mathbf{B_{54}} = -\left(x_{14}-\tfrac{1}{2}\right)\mathbf{a}_1 - y_{14}\,\mathbf{a}_2 + \left(z_{14}+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(x_{14}-\tfrac{1}{2}\right)\hat{\mathbf{x}} - by_{14}\,\hat{\mathbf{y}} + c\left(z_{14}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (4a) \quad \text{H IX}$$

$$\mathbf{B_{55}} = -x_{14}\,\mathbf{a}_1 + \left(y_{14}+\tfrac{1}{2}\right)\mathbf{a}_2 - \left(z_{14}-\tfrac{1}{2}\right)\mathbf{a}_3 = -ax_{14}\,\hat{\mathbf{x}} + b\left(y_{14}+\tfrac{1}{2}\right)\hat{\mathbf{y}} - c\left(z_{14}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (4a) \quad \text{H IX}$$

$$\mathbf{B_{56}} = \left(x_{14}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_{14}-\tfrac{1}{2}\right)\mathbf{a}_2 - z_{14}\,\mathbf{a}_3 = a\left(x_{14}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - b\left(y_{14}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - cz_{14}\,\hat{\mathbf{z}} \quad (4a) \quad \text{H IX}$$

$$\mathbf{B_{57}} = x_{15}\,\mathbf{a}_1 + y_{15}\,\mathbf{a}_2 + z_{15}\,\mathbf{a}_3 = ax_{15}\,\hat{\mathbf{x}} + by_{15}\,\hat{\mathbf{y}} + cz_{15}\,\hat{\mathbf{z}} \quad (4a) \quad \text{H X}$$

$$\mathbf{B_{58}} = -\left(x_{15}-\tfrac{1}{2}\right)\mathbf{a}_1 - y_{15}\,\mathbf{a}_2 + \left(z_{15}+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(x_{15}-\tfrac{1}{2}\right)\hat{\mathbf{x}} - by_{15}\,\hat{\mathbf{y}} + c\left(z_{15}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (4a) \quad \text{H X}$$

$$\mathbf{B_{59}} = -x_{15}\,\mathbf{a}_1 + \left(y_{15}+\tfrac{1}{2}\right)\mathbf{a}_2 - \left(z_{15}-\tfrac{1}{2}\right)\mathbf{a}_3 = -ax_{15}\,\hat{\mathbf{x}} + b\left(y_{15}+\tfrac{1}{2}\right)\hat{\mathbf{y}} - c\left(z_{15}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (4a) \quad \text{H X}$$

$$\mathbf{B_{60}} = \left(x_{15}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_{15}-\tfrac{1}{2}\right)\mathbf{a}_2 - z_{15}\,\mathbf{a}_3 = a\left(x_{15}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - b\left(y_{15}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - cz_{15}\,\hat{\mathbf{z}} \quad (4a) \quad \text{H X}$$

$$\mathbf{B_{61}} = x_{16}\,\mathbf{a}_1 + y_{16}\,\mathbf{a}_2 + z_{16}\,\mathbf{a}_3 = ax_{16}\,\hat{\mathbf{x}} + by_{16}\,\hat{\mathbf{y}} + cz_{16}\,\hat{\mathbf{z}} \quad (4a) \quad \text{O I}$$

$$\mathbf{B_{62}} = -\left(x_{16}-\tfrac{1}{2}\right)\mathbf{a}_1 - y_{16}\,\mathbf{a}_2 + \left(z_{16}+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(x_{16}-\tfrac{1}{2}\right)\hat{\mathbf{x}} - by_{16}\,\hat{\mathbf{y}} + c\left(z_{16}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (4a) \quad \text{O I}$$

$$\mathbf{B_{63}} = -x_{16}\,\mathbf{a}_1 + \left(y_{16}+\tfrac{1}{2}\right)\mathbf{a}_2 - \left(z_{16}-\tfrac{1}{2}\right)\mathbf{a}_3 = -ax_{16}\,\hat{\mathbf{x}} + b\left(y_{16}+\tfrac{1}{2}\right)\hat{\mathbf{y}} - c\left(z_{16}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (4a) \quad \text{O I}$$

$$\mathbf{B_{64}} = \left(x_{16}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_{16}-\tfrac{1}{2}\right)\mathbf{a}_2 - z_{16}\,\mathbf{a}_3 = a\left(x_{16}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - b\left(y_{16}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - cz_{16}\,\hat{\mathbf{z}} \quad (4a) \quad \text{O I}$$

$$\mathbf{B_{65}} = x_{17}\,\mathbf{a}_1 + y_{17}\,\mathbf{a}_2 + z_{17}\,\mathbf{a}_3 = ax_{17}\,\hat{\mathbf{x}} + by_{17}\,\hat{\mathbf{y}} + cz_{17}\,\hat{\mathbf{z}} \quad (4a) \quad \text{O II}$$

$$\mathbf{B_{66}} = -\left(x_{17}-\tfrac{1}{2}\right)\mathbf{a}_1 - y_{17}\,\mathbf{a}_2 + \left(z_{17}+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(x_{17}-\tfrac{1}{2}\right)\hat{\mathbf{x}} - by_{17}\,\hat{\mathbf{y}} + c\left(z_{17}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (4a) \quad \text{O II}$$

$$\mathbf{B_{67}} = -x_{17}\,\mathbf{a}_1 + \left(y_{17}+\tfrac{1}{2}\right)\mathbf{a}_2 - \left(z_{17}-\tfrac{1}{2}\right)\mathbf{a}_3 = -ax_{17}\,\hat{\mathbf{x}} + b\left(y_{17}+\tfrac{1}{2}\right)\hat{\mathbf{y}} - c\left(z_{17}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (4a) \quad \text{O II}$$

$$\mathbf{B_{68}} = \left(x_{17}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_{17}-\tfrac{1}{2}\right)\mathbf{a}_2 - z_{17}\,\mathbf{a}_3 = a\left(x_{17}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - b\left(y_{17}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - cz_{17}\,\hat{\mathbf{z}} \quad (4a) \quad \text{O II}$$

$$\mathbf{B_{69}} = x_{18}\,\mathbf{a}_1 + y_{18}\,\mathbf{a}_2 + z_{18}\,\mathbf{a}_3 = ax_{18}\,\hat{\mathbf{x}} + by_{18}\,\hat{\mathbf{y}} + cz_{18}\,\hat{\mathbf{z}} \quad (4a) \quad \text{O III}$$

$$\mathbf{B_{70}} = -\left(x_{18}-\tfrac{1}{2}\right)\mathbf{a}_1 - y_{18}\,\mathbf{a}_2 + \left(z_{18}+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(x_{18}-\tfrac{1}{2}\right)\hat{\mathbf{x}} - by_{18}\,\hat{\mathbf{y}} + c\left(z_{18}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (4a) \quad \text{O III}$$

$$\mathbf{B_{71}} = -x_{18}\,\mathbf{a}_1 + \left(y_{18}+\tfrac{1}{2}\right)\mathbf{a}_2 - \left(z_{18}-\tfrac{1}{2}\right)\mathbf{a}_3 = -ax_{18}\,\hat{\mathbf{x}} + b\left(y_{18}+\tfrac{1}{2}\right)\hat{\mathbf{y}} - c\left(z_{18}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (4a) \quad \text{O III}$$

$$\mathbf{B_{72}} = \left(x_{18}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_{18}-\tfrac{1}{2}\right)\mathbf{a}_2 - z_{18}\,\mathbf{a}_3 = a\left(x_{18}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - b\left(y_{18}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - cz_{18}\,\hat{\mathbf{z}} \quad (4a) \quad \text{O III}$$

$$\mathbf{B_{73}} = x_{19}\,\mathbf{a}_1 + y_{19}\,\mathbf{a}_2 + z_{19}\,\mathbf{a}_3 = ax_{19}\,\hat{\mathbf{x}} + by_{19}\,\hat{\mathbf{y}} + cz_{19}\,\hat{\mathbf{z}} \quad (4a) \quad \text{O IV}$$

$$\mathbf{B_{74}} = -\left(x_{19}-\tfrac{1}{2}\right)\mathbf{a}_1 - y_{19}\,\mathbf{a}_2 + \left(z_{19}+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(x_{19}-\tfrac{1}{2}\right)\hat{\mathbf{x}} - by_{19}\,\hat{\mathbf{y}} + c\left(z_{19}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (4a) \quad \text{O IV}$$

$$\mathbf{B_{75}} = -x_{19}\,\mathbf{a}_1 + \left(y_{19}+\tfrac{1}{2}\right)\mathbf{a}_2 - \left(z_{19}-\tfrac{1}{2}\right)\mathbf{a}_3 = -ax_{19}\,\hat{\mathbf{x}} + b\left(y_{19}+\tfrac{1}{2}\right)\hat{\mathbf{y}} - c\left(z_{19}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (4a) \quad \text{O IV}$$

$$\mathbf{B_{76}} = \left(x_{19}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_{19}-\tfrac{1}{2}\right)\mathbf{a}_2 - z_{19}\,\mathbf{a}_3 = a\left(x_{19}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - b\left(y_{19}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - cz_{19}\,\hat{\mathbf{z}} \quad (4a) \quad \text{O IV}$$

$$\mathbf{B_{77}} = x_{20}\,\mathbf{a}_1 + y_{20}\,\mathbf{a}_2 + z_{20}\,\mathbf{a}_3 = ax_{20}\,\hat{\mathbf{x}} + by_{20}\,\hat{\mathbf{y}} + cz_{20}\,\hat{\mathbf{z}} \quad (4a) \quad \text{O V}$$

$\mathbf{B_{78}}$	=	$-\left(x_{20}-\frac{1}{2}\right)\,\mathbf{a}_1 - y_{20}\,\mathbf{a}_2 + \left(z_{20}+\frac{1}{2}\right)\,\mathbf{a}_3$	=	$-a\left(x_{20}-\frac{1}{2}\right)\,\hat{\mathbf{x}} - by_{20}\,\hat{\mathbf{y}} + c\left(z_{20}+\frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	O V
$\mathbf{B_{79}}$	=	$-x_{20}\,\mathbf{a}_1 + \left(y_{20}+\frac{1}{2}\right)\,\mathbf{a}_2 - \left(z_{20}-\frac{1}{2}\right)\,\mathbf{a}_3$	=	$-ax_{20}\,\hat{\mathbf{x}} + b\left(y_{20}+\frac{1}{2}\right)\,\hat{\mathbf{y}} - c\left(z_{20}-\frac{1}{2}\right)\,\hat{\mathbf{z}}$	(4a)	O V
$\mathbf{B_{80}}$	=	$\left(x_{20}+\frac{1}{2}\right)\,\mathbf{a}_1 - \left(y_{20}-\frac{1}{2}\right)\,\mathbf{a}_2 - z_{20}\,\mathbf{a}_3$	=	$a\left(x_{20}+\frac{1}{2}\right)\,\hat{\mathbf{x}} - b\left(y_{20}-\frac{1}{2}\right)\,\hat{\mathbf{y}} - cz_{20}\,\hat{\mathbf{z}}$	(4a)	O V

References

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