β-Eucryptite ($LiAlSiO_4$) Structure: ABC4D_hP84_181_gi_bcf_4k_hj-001

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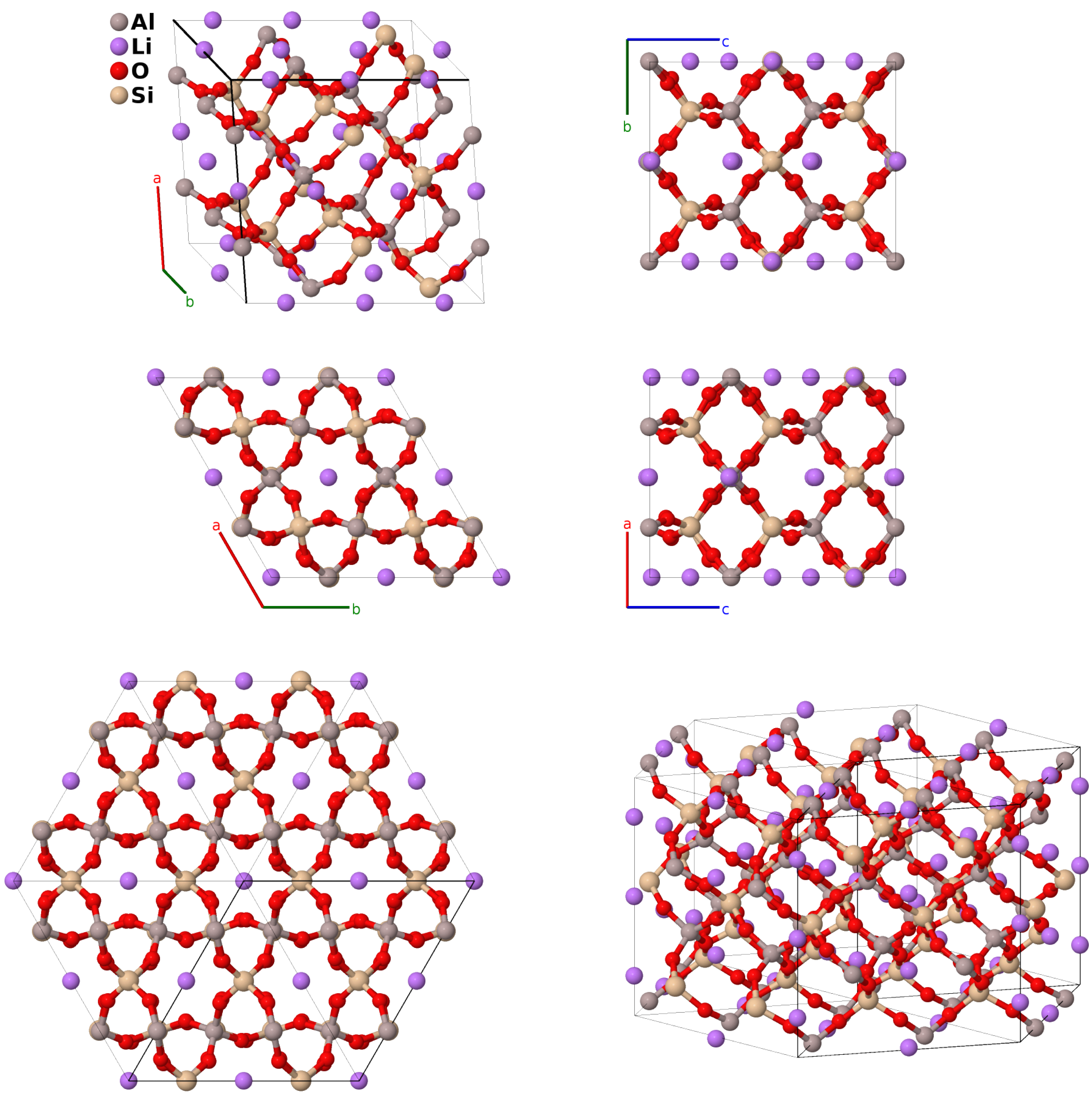
https://aflow.org/p/N1MQ

https://aflow.org/p/ABC4D_hP84_181_gi_bcf_4k_hj-001



Prototype $AlLiO_4Si$

AFLOW prototype label ABC4D_hP84_181_gi_bcf_4k_hj-001

Mineral name eucryptite

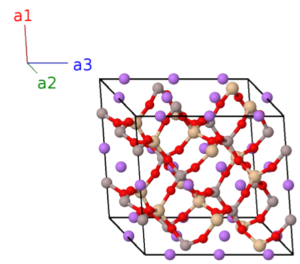
ICSD 22010

Pearson symbol	hP84
Space group number	181
Space group symbol	$P6_422$
AFLOW prototype command	`aflow --proto=ABC4D_hP84_181_gi_bcf_4k_hj-001` `--params=`$a, c/a, z_3, x_4, x_5, x_6, x_7, x_8, y_8, z_8, x_9, y_9, z_9, x_{10}, y_{10}, z_{10}, x_{11}, y_{11}, z_{11}$

- We use the data taken by (Pillars, 1973) at 23°C.
- α-eucryptite takes on the rhombohedral $LiZnPO_4$ structure (Daniels, 2001).
- This structure can also be found in the enantiomorphic space group $P6_222$ #180.

Hexagonal primitive vectors

$$
\begin{aligned}
\mathbf{a_1} &= \tfrac{1}{2}a\,\hat{\mathbf{x}} - \tfrac{\sqrt{3}}{2}a\,\hat{\mathbf{y}} \\
\mathbf{a_2} &= \tfrac{1}{2}a\,\hat{\mathbf{x}} + \tfrac{\sqrt{3}}{2}a\,\hat{\mathbf{y}} \\
\mathbf{a_3} &= c\,\hat{\mathbf{z}}
\end{aligned}
$$



Basis vectors

		Lattice coordinates		Cartesian coordinates	Wyckoff position	Atom type
$\mathbf{B_1}$	=	$\frac{1}{2}\,\mathbf{a}_3$	=	$\frac{1}{2}c\,\hat{\mathbf{z}}$	(3b)	Li I
$\mathbf{B_2}$	=	$\frac{5}{6}\,\mathbf{a}_3$	=	$\frac{5}{6}c\,\hat{\mathbf{z}}$	(3b)	Li I
$\mathbf{B_3}$	=	$\frac{1}{6}\,\mathbf{a}_3$	=	$\frac{1}{6}c\,\hat{\mathbf{z}}$	(3b)	Li I
$\mathbf{B_4}$	=	$\frac{1}{2}\,\mathbf{a}_1$	=	$\frac{1}{4}a\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{4}a\,\hat{\mathbf{y}}$	(3c)	Li II
$\mathbf{B_5}$	=	$\frac{1}{2}\,\mathbf{a}_2 + \frac{1}{3}\,\mathbf{a}_3$	=	$\frac{1}{4}a\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{4}a\,\hat{\mathbf{y}} + \frac{1}{3}c\,\hat{\mathbf{z}}$	(3c)	Li II
$\mathbf{B_6}$	=	$\frac{1}{2}\,\mathbf{a}_1 + \frac{1}{2}\,\mathbf{a}_2 + \frac{2}{3}\,\mathbf{a}_3$	=	$\frac{1}{2}a\,\hat{\mathbf{x}} + \frac{2}{3}c\,\hat{\mathbf{z}}$	(3c)	Li II
$\mathbf{B_7}$	=	$\frac{1}{2}\,\mathbf{a}_1 + z_3\,\mathbf{a}_3$	=	$\frac{1}{4}a\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{4}a\,\hat{\mathbf{y}} + cz_3\,\hat{\mathbf{z}}$	(6f)	Li III
$\mathbf{B_8}$	=	$\frac{1}{2}\,\mathbf{a}_2 + \left(z_3 + \frac{1}{3}\right)\,\mathbf{a}_3$	=	$\frac{1}{4}a\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{4}a\,\hat{\mathbf{y}} + c\left(z_3 + \frac{1}{3}\right)\,\hat{\mathbf{z}}$	(6f)	Li III
$\mathbf{B_9}$	=	$\frac{1}{2}\,\mathbf{a}_1 + \frac{1}{2}\,\mathbf{a}_2 + \left(z_3 + \frac{2}{3}\right)\,\mathbf{a}_3$	=	$\frac{1}{2}a\,\hat{\mathbf{x}} + \frac{1}{3}c\left(3z_3 + 2\right)\,\hat{\mathbf{z}}$	(6f)	Li III
$\mathbf{B_{10}}$	=	$\frac{1}{2}\,\mathbf{a}_2 - \left(z_3 - \frac{1}{3}\right)\,\mathbf{a}_3$	=	$\frac{1}{4}a\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{4}a\,\hat{\mathbf{y}} - c\left(z_3 - \frac{1}{3}\right)\,\hat{\mathbf{z}}$	(6f)	Li III
$\mathbf{B_{11}}$	=	$\frac{1}{2}\,\mathbf{a}_1 - z_3\,\mathbf{a}_3$	=	$\frac{1}{4}a\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{4}a\,\hat{\mathbf{y}} - cz_3\,\hat{\mathbf{z}}$	(6f)	Li III
$\mathbf{B_{12}}$	=	$\frac{1}{2}\,\mathbf{a}_1 + \frac{1}{2}\,\mathbf{a}_2 - \left(z_3 - \frac{2}{3}\right)\,\mathbf{a}_3$	=	$\frac{1}{2}a\,\hat{\mathbf{x}} - \frac{1}{3}c\left(3z_3 - 2\right)\,\hat{\mathbf{z}}$	(6f)	Li III
$\mathbf{B_{13}}$	=	$x_4\,\mathbf{a}_1$	=	$\frac{1}{2}ax_4\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{2}ax_4\,\hat{\mathbf{y}}$	(6g)	Al I
$\mathbf{B_{14}}$	=	$x_4\,\mathbf{a}_2 + \frac{1}{3}\,\mathbf{a}_3$	=	$\frac{1}{2}ax_4\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{2}ax_4\,\hat{\mathbf{y}} + \frac{1}{3}c\,\hat{\mathbf{z}}$	(6g)	Al I
$\mathbf{B_{15}}$	=	$-x_4\,\mathbf{a}_1 - x_4\,\mathbf{a}_2 + \frac{2}{3}\,\mathbf{a}_3$	=	$-ax_4\,\hat{\mathbf{x}} + \frac{2}{3}c\,\hat{\mathbf{z}}$	(6g)	Al I
$\mathbf{B_{16}}$	=	$-x_4\,\mathbf{a}_1$	=	$-\frac{1}{2}ax_4\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{2}ax_4\,\hat{\mathbf{y}}$	(6g)	Al I
$\mathbf{B_{17}}$	=	$-x_4\,\mathbf{a}_2 + \frac{1}{3}\,\mathbf{a}_3$	=	$-\frac{1}{2}ax_4\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{2}ax_4\,\hat{\mathbf{y}} + \frac{1}{3}c\,\hat{\mathbf{z}}$	(6g)	Al I
$\mathbf{B_{18}}$	=	$x_4\,\mathbf{a}_1 + x_4\,\mathbf{a}_2 + \frac{2}{3}\,\mathbf{a}_3$	=	$ax_4\,\hat{\mathbf{x}} + \frac{2}{3}c\,\hat{\mathbf{z}}$	(6g)	Al I
$\mathbf{B_{19}}$	=	$x_5\,\mathbf{a}_1 + \frac{1}{2}\,\mathbf{a}_3$	=	$\frac{1}{2}ax_5\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{2}ax_5\,\hat{\mathbf{y}} + \frac{1}{2}c\,\hat{\mathbf{z}}$	(6h)	Si I

$\mathbf{B_{20}}$	=	$x_5\,\mathbf{a}_2 + \frac{5}{6}\,\mathbf{a}_3$	=	$\frac{1}{2}ax_5\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{2}ax_5\,\hat{\mathbf{y}} + \frac{5}{6}c\,\hat{\mathbf{z}}$	(6h)	Si I
$\mathbf{B_{21}}$	=	$-x_5\,\mathbf{a}_1 - x_5\,\mathbf{a}_2 + \frac{1}{6}\,\mathbf{a}_3$	=	$-ax_5\,\hat{\mathbf{x}} + \frac{1}{6}c\,\hat{\mathbf{z}}$	(6h)	Si I
$\mathbf{B_{22}}$	=	$-x_5\,\mathbf{a}_1 + \frac{1}{2}\,\mathbf{a}_3$	=	$-\frac{1}{2}ax_5\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{2}ax_5\,\hat{\mathbf{y}} + \frac{1}{2}c\,\hat{\mathbf{z}}$	(6h)	Si I
$\mathbf{B_{23}}$	=	$-x_5\,\mathbf{a}_2 + \frac{5}{6}\,\mathbf{a}_3$	=	$-\frac{1}{2}ax_5\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{2}ax_5\,\hat{\mathbf{y}} + \frac{5}{6}c\,\hat{\mathbf{z}}$	(6h)	Si I
$\mathbf{B_{24}}$	=	$x_5\,\mathbf{a}_1 + x_5\,\mathbf{a}_2 + \frac{1}{6}\,\mathbf{a}_3$	=	$ax_5\,\hat{\mathbf{x}} + \frac{1}{6}c\,\hat{\mathbf{z}}$	(6h)	Si I
$\mathbf{B_{25}}$	=	$x_6\,\mathbf{a}_1 + 2x_6\,\mathbf{a}_2$	=	$\frac{3}{2}ax_6\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{2}ax_6\,\hat{\mathbf{y}}$	(6i)	Al II
$\mathbf{B_{26}}$	=	$-2x_6\,\mathbf{a}_1 - x_6\,\mathbf{a}_2 + \frac{1}{3}\,\mathbf{a}_3$	=	$-\frac{3}{2}ax_6\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{2}ax_6\,\hat{\mathbf{y}} + \frac{1}{3}c\,\hat{\mathbf{z}}$	(6i)	Al II
$\mathbf{B_{27}}$	=	$x_6\,\mathbf{a}_1 - x_6\,\mathbf{a}_2 + \frac{2}{3}\,\mathbf{a}_3$	=	$-\sqrt{3}ax_6\,\hat{\mathbf{y}} + \frac{2}{3}c\,\hat{\mathbf{z}}$	(6i)	Al II
$\mathbf{B_{28}}$	=	$-x_6\,\mathbf{a}_1 - 2x_6\,\mathbf{a}_2$	=	$-\frac{3}{2}ax_6\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{2}ax_6\,\hat{\mathbf{y}}$	(6i)	Al II
$\mathbf{B_{29}}$	=	$2x_6\,\mathbf{a}_1 + x_6\,\mathbf{a}_2 + \frac{1}{3}\,\mathbf{a}_3$	=	$\frac{3}{2}ax_6\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{2}ax_6\,\hat{\mathbf{y}} + \frac{1}{3}c\,\hat{\mathbf{z}}$	(6i)	Al II
$\mathbf{B_{30}}$	=	$-x_6\,\mathbf{a}_1 + x_6\,\mathbf{a}_2 + \frac{2}{3}\,\mathbf{a}_3$	=	$\sqrt{3}ax_6\,\hat{\mathbf{y}} + \frac{2}{3}c\,\hat{\mathbf{z}}$	(6i)	Al II
$\mathbf{B_{31}}$	=	$x_7\,\mathbf{a}_1 + 2x_7\,\mathbf{a}_2 + \frac{1}{2}\,\mathbf{a}_3$	=	$\frac{3}{2}ax_7\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{2}ax_7\,\hat{\mathbf{y}} + \frac{1}{2}c\,\hat{\mathbf{z}}$	(6j)	Si II
$\mathbf{B_{32}}$	=	$-2x_7\,\mathbf{a}_1 - x_7\,\mathbf{a}_2 + \frac{5}{6}\,\mathbf{a}_3$	=	$-\frac{3}{2}ax_7\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{2}ax_7\,\hat{\mathbf{y}} + \frac{5}{6}c\,\hat{\mathbf{z}}$	(6j)	Si II
$\mathbf{B_{33}}$	=	$x_7\,\mathbf{a}_1 - x_7\,\mathbf{a}_2 + \frac{1}{6}\,\mathbf{a}_3$	=	$-\sqrt{3}ax_7\,\hat{\mathbf{y}} + \frac{1}{6}c\,\hat{\mathbf{z}}$	(6j)	Si II
$\mathbf{B_{34}}$	=	$-x_7\,\mathbf{a}_1 - 2x_7\,\mathbf{a}_2 + \frac{1}{2}\,\mathbf{a}_3$	=	$-\frac{3}{2}ax_7\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{2}ax_7\,\hat{\mathbf{y}} + \frac{1}{2}c\,\hat{\mathbf{z}}$	(6j)	Si II
$\mathbf{B_{35}}$	=	$2x_7\,\mathbf{a}_1 + x_7\,\mathbf{a}_2 + \frac{5}{6}\,\mathbf{a}_3$	=	$\frac{3}{2}ax_7\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{2}ax_7\,\hat{\mathbf{y}} + \frac{5}{6}c\,\hat{\mathbf{z}}$	(6j)	Si II
$\mathbf{B_{36}}$	=	$-x_7\,\mathbf{a}_1 + x_7\,\mathbf{a}_2 + \frac{1}{6}\,\mathbf{a}_3$	=	$\sqrt{3}ax_7\,\hat{\mathbf{y}} + \frac{1}{6}c\,\hat{\mathbf{z}}$	(6j)	Si II
$\mathbf{B_{37}}$	=	$x_8\,\mathbf{a}_1 + y_8\,\mathbf{a}_2 + z_8\,\mathbf{a}_3$	=	$\frac{1}{2}a\left(x_8+y_8\right)\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{2}a\left(x_8-y_8\right)\,\hat{\mathbf{y}} + cz_8\,\hat{\mathbf{z}}$	(12k)	O I
$\mathbf{B_{38}}$	=	$-y_8\,\mathbf{a}_1 + \left(x_8-y_8\right)\,\mathbf{a}_2 + \left(z_8+\frac{1}{3}\right)\,\mathbf{a}_3$	=	$\frac{1}{2}a\left(x_8-2y_8\right)\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{2}ax_8\,\hat{\mathbf{y}} + c\left(z_8+\frac{1}{3}\right)\,\hat{\mathbf{z}}$	(12k)	O I
$\mathbf{B_{39}}$	=	$-\left(x_8-y_8\right)\,\mathbf{a}_1 - x_8\,\mathbf{a}_2 + \left(z_8+\frac{2}{3}\right)\,\mathbf{a}_3$	=	$-\frac{1}{2}a\left(2x_8-y_8\right)\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{2}ay_8\,\hat{\mathbf{y}} + \frac{1}{3}c\left(3z_8+2\right)\,\hat{\mathbf{z}}$	(12k)	O I
$\mathbf{B_{40}}$	=	$-x_8\,\mathbf{a}_1 - y_8\,\mathbf{a}_2 + z_8\,\mathbf{a}_3$	=	$-\frac{1}{2}a\left(x_8+y_8\right)\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{2}a\left(x_8-y_8\right)\,\hat{\mathbf{y}} + cz_8\,\hat{\mathbf{z}}$	(12k)	O I
$\mathbf{B_{41}}$	=	$y_8\,\mathbf{a}_1 - \left(x_8-y_8\right)\,\mathbf{a}_2 + \left(z_8+\frac{1}{3}\right)\,\mathbf{a}_3$	=	$\frac{1}{2}a\left(-x_8+2y_8\right)\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{2}ax_8\,\hat{\mathbf{y}} + c\left(z_8+\frac{1}{3}\right)\,\hat{\mathbf{z}}$	(12k)	O I
$\mathbf{B_{42}}$	=	$\left(x_8-y_8\right)\,\mathbf{a}_1 + x_8\,\mathbf{a}_2 + \left(z_8+\frac{2}{3}\right)\,\mathbf{a}_3$	=	$\frac{1}{2}a\left(2x_8-y_8\right)\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{2}ay_8\,\hat{\mathbf{y}} + \frac{1}{3}c\left(3z_8+2\right)\,\hat{\mathbf{z}}$	(12k)	O I
$\mathbf{B_{43}}$	=	$y_8\,\mathbf{a}_1 + x_8\,\mathbf{a}_2 - \left(z_8-\frac{1}{3}\right)\,\mathbf{a}_3$	=	$\frac{1}{2}a\left(x_8+y_8\right)\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{2}a\left(x_8-y_8\right)\,\hat{\mathbf{y}} - c\left(z_8-\frac{1}{3}\right)\,\hat{\mathbf{z}}$	(12k)	O I
$\mathbf{B_{44}}$	=	$\left(x_8-y_8\right)\,\mathbf{a}_1 - y_8\,\mathbf{a}_2 - z_8\,\mathbf{a}_3$	=	$\frac{1}{2}a\left(x_8-2y_8\right)\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{2}ax_8\,\hat{\mathbf{y}} - cz_8\,\hat{\mathbf{z}}$	(12k)	O I
$\mathbf{B_{45}}$	=	$-x_8\,\mathbf{a}_1 - \left(x_8-y_8\right)\,\mathbf{a}_2 - \left(z_8-\frac{2}{3}\right)\,\mathbf{a}_3$	=	$-\frac{1}{2}a\left(2x_8-y_8\right)\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{2}ay_8\,\hat{\mathbf{y}} - \frac{1}{3}c\left(3z_8-2\right)\,\hat{\mathbf{z}}$	(12k)	O I
$\mathbf{B_{46}}$	=	$-y_8\,\mathbf{a}_1 - x_8\,\mathbf{a}_2 - \left(z_8-\frac{1}{3}\right)\,\mathbf{a}_3$	=	$-\frac{1}{2}a\left(x_8+y_8\right)\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{2}a\left(x_8-y_8\right)\,\hat{\mathbf{y}} - c\left(z_8-\frac{1}{3}\right)\,\hat{\mathbf{z}}$	(12k)	O I
$\mathbf{B_{47}}$	=	$-\left(x_8-y_8\right)\,\mathbf{a}_1 + y_8\,\mathbf{a}_2 - z_8\,\mathbf{a}_3$	=	$\frac{1}{2}a\left(-x_8+2y_8\right)\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{2}ax_8\,\hat{\mathbf{y}} - cz_8\,\hat{\mathbf{z}}$	(12k)	O I
$\mathbf{B_{48}}$	=	$x_8\,\mathbf{a}_1 + \left(x_8-y_8\right)\,\mathbf{a}_2 - \left(z_8-\frac{2}{3}\right)\,\mathbf{a}_3$	=	$\frac{1}{2}a\left(2x_8-y_8\right)\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{2}ay_8\,\hat{\mathbf{y}} - \frac{1}{3}c\left(3z_8-2\right)\,\hat{\mathbf{z}}$	(12k)	O I
$\mathbf{B_{49}}$	=	$x_9\,\mathbf{a}_1 + y_9\,\mathbf{a}_2 + z_9\,\mathbf{a}_3$	=	$\frac{1}{2}a\left(x_9+y_9\right)\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{2}a\left(x_9-y_9\right)\,\hat{\mathbf{y}} + cz_9\,\hat{\mathbf{z}}$	(12k)	O II
$\mathbf{B_{50}}$	=	$-y_9\,\mathbf{a}_1 + \left(x_9-y_9\right)\,\mathbf{a}_2 + \left(z_9+\frac{1}{3}\right)\,\mathbf{a}_3$	=	$\frac{1}{2}a\left(x_9-2y_9\right)\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{2}ax_9\,\hat{\mathbf{y}} + c\left(z_9+\frac{1}{3}\right)\,\hat{\mathbf{z}}$	(12k)	O II
$\mathbf{B_{51}}$	=	$-\left(x_9-y_9\right)\,\mathbf{a}_1 - x_9\,\mathbf{a}_2 + \left(z_9+\frac{2}{3}\right)\,\mathbf{a}_3$	=	$-\frac{1}{2}a\left(2x_9-y_9\right)\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{2}ay_9\,\hat{\mathbf{y}} + \frac{1}{3}c\left(3z_9+2\right)\,\hat{\mathbf{z}}$	(12k)	O II
$\mathbf{B_{52}}$	=	$-x_9\,\mathbf{a}_1 - y_9\,\mathbf{a}_2 + z_9\,\mathbf{a}_3$	=	$-\frac{1}{2}a\left(x_9+y_9\right)\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{2}a\left(x_9-y_9\right)\,\hat{\mathbf{y}} + cz_9\,\hat{\mathbf{z}}$	(12k)	O II
$\mathbf{B_{53}}$	=	$y_9\,\mathbf{a}_1 - \left(x_9-y_9\right)\,\mathbf{a}_2 + \left(z_9+\frac{1}{3}\right)\,\mathbf{a}_3$	=	$\frac{1}{2}a\left(-x_9+2y_9\right)\,\hat{\mathbf{x}} - \frac{\sqrt{3}}{2}ax_9\,\hat{\mathbf{y}} + c\left(z_9+\frac{1}{3}\right)\,\hat{\mathbf{z}}$	(12k)	O II
$\mathbf{B_{54}}$	=	$\left(x_9-y_9\right)\,\mathbf{a}_1 + x_9\,\mathbf{a}_2 + \left(z_9+\frac{2}{3}\right)\,\mathbf{a}_3$	=	$\frac{1}{2}a\left(2x_9-y_9\right)\,\hat{\mathbf{x}} + \frac{\sqrt{3}}{2}ay_9\,\hat{\mathbf{y}} + \frac{1}{3}c\left(3z_9+2\right)\,\hat{\mathbf{z}}$	(12k)	O II

$\mathbf{B_{55}}$	=	$y_{9}\,\mathbf{a}_{1} + x_{9}\,\mathbf{a}_{2} - \left(z_{9} - \frac{1}{3}\right)\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(x_{9}+y_{9}\right)\,\mathbf{\hat{x}} + \frac{\sqrt{3}}{2}a\left(x_{9}-y_{9}\right)\,\mathbf{\hat{y}} - c\left(z_{9} - \frac{1}{3}\right)\,\mathbf{\hat{z}}$	(12k)	O II
$\mathbf{B_{56}}$	=	$\left(x_{9}-y_{9}\right)\,\mathbf{a}_{1} - y_{9}\,\mathbf{a}_{2} - z_{9}\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(x_{9}-2y_{9}\right)\,\mathbf{\hat{x}} - \frac{\sqrt{3}}{2}ax_{9}\,\mathbf{\hat{y}} - cz_{9}\,\mathbf{\hat{z}}$	(12k)	O II
$\mathbf{B_{57}}$	=	$-x_{9}\,\mathbf{a}_{1} - \left(x_{9}-y_{9}\right)\,\mathbf{a}_{2} - \left(z_{9} - \frac{2}{3}\right)\,\mathbf{a}_{3}$	=	$-\frac{1}{2}a\left(2x_{9}-y_{9}\right)\,\mathbf{\hat{x}} + \frac{\sqrt{3}}{2}ay_{9}\,\mathbf{\hat{y}} - \frac{1}{3}c\left(3z_{9}-2\right)\,\mathbf{\hat{z}}$	(12k)	O II
$\mathbf{B_{58}}$	=	$-y_{9}\,\mathbf{a}_{1} - x_{9}\,\mathbf{a}_{2} - \left(z_{9} - \frac{1}{3}\right)\,\mathbf{a}_{3}$	=	$-\frac{1}{2}a\left(x_{9}+y_{9}\right)\,\mathbf{\hat{x}} - \frac{\sqrt{3}}{2}a\left(x_{9}-y_{9}\right)\,\mathbf{\hat{y}} - c\left(z_{9} - \frac{1}{3}\right)\,\mathbf{\hat{z}}$	(12k)	O II
$\mathbf{B_{59}}$	=	$-\left(x_{9}-y_{9}\right)\,\mathbf{a}_{1} + y_{9}\,\mathbf{a}_{2} - z_{9}\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(-x_{9}+2y_{9}\right)\,\mathbf{\hat{x}} + \frac{\sqrt{3}}{2}ax_{9}\,\mathbf{\hat{y}} - cz_{9}\,\mathbf{\hat{z}}$	(12k)	O II
$\mathbf{B_{60}}$	=	$x_{9}\,\mathbf{a}_{1} + \left(x_{9}-y_{9}\right)\,\mathbf{a}_{2} - \left(z_{9} - \frac{2}{3}\right)\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(2x_{9}-y_{9}\right)\,\mathbf{\hat{x}} - \frac{\sqrt{3}}{2}ay_{9}\,\mathbf{\hat{y}} - \frac{1}{3}c\left(3z_{9}-2\right)\,\mathbf{\hat{z}}$	(12k)	O II
$\mathbf{B_{61}}$	=	$x_{10}\,\mathbf{a}_{1} + y_{10}\,\mathbf{a}_{2} + z_{10}\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(x_{10}+y_{10}\right)\,\mathbf{\hat{x}} - \frac{\sqrt{3}}{2}a\left(x_{10}-y_{10}\right)\,\mathbf{\hat{y}} + cz_{10}\,\mathbf{\hat{z}}$	(12k)	O III
$\mathbf{B_{62}}$	=	$-y_{10}\,\mathbf{a}_{1} + \left(x_{10}-y_{10}\right)\,\mathbf{a}_{2} + \left(z_{10} + \frac{1}{3}\right)\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(x_{10}-2y_{10}\right)\,\mathbf{\hat{x}} + \frac{\sqrt{3}}{2}ax_{10}\,\mathbf{\hat{y}} + c\left(z_{10} + \frac{1}{3}\right)\,\mathbf{\hat{z}}$	(12k)	O III
$\mathbf{B_{63}}$	=	$-\left(x_{10}-y_{10}\right)\,\mathbf{a}_{1} - x_{10}\,\mathbf{a}_{2} + \left(z_{10} + \frac{2}{3}\right)\,\mathbf{a}_{3}$	=	$-\frac{1}{2}a\left(2x_{10}-y_{10}\right)\,\mathbf{\hat{x}} - \frac{\sqrt{3}}{2}ay_{10}\,\mathbf{\hat{y}} + \frac{1}{3}c\left(3z_{10}+2\right)\,\mathbf{\hat{z}}$	(12k)	O III
$\mathbf{B_{64}}$	=	$-x_{10}\,\mathbf{a}_{1} - y_{10}\,\mathbf{a}_{2} + z_{10}\,\mathbf{a}_{3}$	=	$-\frac{1}{2}a\left(x_{10}+y_{10}\right)\,\mathbf{\hat{x}} + \frac{\sqrt{3}}{2}a\left(x_{10}-y_{10}\right)\,\mathbf{\hat{y}} + cz_{10}\,\mathbf{\hat{z}}$	(12k)	O III
$\mathbf{B_{65}}$	=	$y_{10}\,\mathbf{a}_{1} - \left(x_{10}-y_{10}\right)\,\mathbf{a}_{2} + \left(z_{10} + \frac{1}{3}\right)\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(-x_{10}+2y_{10}\right)\,\mathbf{\hat{x}} - \frac{\sqrt{3}}{2}ax_{10}\,\mathbf{\hat{y}} + c\left(z_{10} + \frac{1}{3}\right)\,\mathbf{\hat{z}}$	(12k)	O III
$\mathbf{B_{66}}$	=	$\left(x_{10}-y_{10}\right)\,\mathbf{a}_{1} + x_{10}\,\mathbf{a}_{2} + \left(z_{10} + \frac{2}{3}\right)\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(2x_{10}-y_{10}\right)\,\mathbf{\hat{x}} + \frac{\sqrt{3}}{2}ay_{10}\,\mathbf{\hat{y}} + \frac{1}{3}c\left(3z_{10}+2\right)\,\mathbf{\hat{z}}$	(12k)	O III
$\mathbf{B_{67}}$	=	$y_{10}\,\mathbf{a}_{1} + x_{10}\,\mathbf{a}_{2} - \left(z_{10} - \frac{1}{3}\right)\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(x_{10}+y_{10}\right)\,\mathbf{\hat{x}} + \frac{\sqrt{3}}{2}a\left(x_{10}-y_{10}\right)\,\mathbf{\hat{y}} - c\left(z_{10} - \frac{1}{3}\right)\,\mathbf{\hat{z}}$	(12k)	O III
$\mathbf{B_{68}}$	=	$\left(x_{10}-y_{10}\right)\,\mathbf{a}_{1} - y_{10}\,\mathbf{a}_{2} - z_{10}\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(x_{10}-2y_{10}\right)\,\mathbf{\hat{x}} - \frac{\sqrt{3}}{2}ax_{10}\,\mathbf{\hat{y}} - cz_{10}\,\mathbf{\hat{z}}$	(12k)	O III
$\mathbf{B_{69}}$	=	$-x_{10}\,\mathbf{a}_{1} - \left(x_{10}-y_{10}\right)\,\mathbf{a}_{2} - \left(z_{10} - \frac{2}{3}\right)\,\mathbf{a}_{3}$	=	$-\frac{1}{2}a\left(2x_{10}-y_{10}\right)\,\mathbf{\hat{x}} + \frac{\sqrt{3}}{2}ay_{10}\,\mathbf{\hat{y}} - \frac{1}{3}c\left(3z_{10}-2\right)\,\mathbf{\hat{z}}$	(12k)	O III
$\mathbf{B_{70}}$	=	$-y_{10}\,\mathbf{a}_{1} - x_{10}\,\mathbf{a}_{2} - \left(z_{10} - \frac{1}{3}\right)\,\mathbf{a}_{3}$	=	$-\frac{1}{2}a\left(x_{10}+y_{10}\right)\,\mathbf{\hat{x}} - \frac{\sqrt{3}}{2}a\left(x_{10}-y_{10}\right)\,\mathbf{\hat{y}} - c\left(z_{10} - \frac{1}{3}\right)\,\mathbf{\hat{z}}$	(12k)	O III
$\mathbf{B_{71}}$	=	$-\left(x_{10}-y_{10}\right)\,\mathbf{a}_{1} + y_{10}\,\mathbf{a}_{2} - z_{10}\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(-x_{10}+2y_{10}\right)\,\mathbf{\hat{x}} + \frac{\sqrt{3}}{2}ax_{10}\,\mathbf{\hat{y}} - cz_{10}\,\mathbf{\hat{z}}$	(12k)	O III
$\mathbf{B_{72}}$	=	$x_{10}\,\mathbf{a}_{1} + \left(x_{10}-y_{10}\right)\,\mathbf{a}_{2} - \left(z_{10} - \frac{2}{3}\right)\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(2x_{10}-y_{10}\right)\,\mathbf{\hat{x}} - \frac{\sqrt{3}}{2}ay_{10}\,\mathbf{\hat{y}} - \frac{1}{3}c\left(3z_{10}-2\right)\,\mathbf{\hat{z}}$	(12k)	O III
$\mathbf{B_{73}}$	=	$x_{11}\,\mathbf{a}_{1} + y_{11}\,\mathbf{a}_{2} + z_{11}\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(x_{11}+y_{11}\right)\,\mathbf{\hat{x}} - \frac{\sqrt{3}}{2}a\left(x_{11}-y_{11}\right)\,\mathbf{\hat{y}} + cz_{11}\,\mathbf{\hat{z}}$	(12k)	O IV
$\mathbf{B_{74}}$	=	$-y_{11}\,\mathbf{a}_{1} + \left(x_{11}-y_{11}\right)\,\mathbf{a}_{2} + \left(z_{11} + \frac{1}{3}\right)\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(x_{11}-2y_{11}\right)\,\mathbf{\hat{x}} + \frac{\sqrt{3}}{2}ax_{11}\,\mathbf{\hat{y}} + c\left(z_{11} + \frac{1}{3}\right)\,\mathbf{\hat{z}}$	(12k)	O IV
$\mathbf{B_{75}}$	=	$-\left(x_{11}-y_{11}\right)\,\mathbf{a}_{1} - x_{11}\,\mathbf{a}_{2} + \left(z_{11} + \frac{2}{3}\right)\,\mathbf{a}_{3}$	=	$-\frac{1}{2}a\left(2x_{11}-y_{11}\right)\,\mathbf{\hat{x}} - \frac{\sqrt{3}}{2}ay_{11}\,\mathbf{\hat{y}} + \frac{1}{3}c\left(3z_{11}+2\right)\,\mathbf{\hat{z}}$	(12k)	O IV
$\mathbf{B_{76}}$	=	$-x_{11}\,\mathbf{a}_{1} - y_{11}\,\mathbf{a}_{2} + z_{11}\,\mathbf{a}_{3}$	=	$-\frac{1}{2}a\left(x_{11}+y_{11}\right)\,\mathbf{\hat{x}} + \frac{\sqrt{3}}{2}a\left(x_{11}-y_{11}\right)\,\mathbf{\hat{y}} + cz_{11}\,\mathbf{\hat{z}}$	(12k)	O IV
$\mathbf{B_{77}}$	=	$y_{11}\,\mathbf{a}_{1} - \left(x_{11}-y_{11}\right)\,\mathbf{a}_{2} + \left(z_{11} + \frac{1}{3}\right)\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(-x_{11}+2y_{11}\right)\,\mathbf{\hat{x}} - \frac{\sqrt{3}}{2}ax_{11}\,\mathbf{\hat{y}} + c\left(z_{11} + \frac{1}{3}\right)\,\mathbf{\hat{z}}$	(12k)	O IV
$\mathbf{B_{78}}$	=	$\left(x_{11}-y_{11}\right)\,\mathbf{a}_{1} + x_{11}\,\mathbf{a}_{2} + \left(z_{11} + \frac{2}{3}\right)\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(2x_{11}-y_{11}\right)\,\mathbf{\hat{x}} + \frac{\sqrt{3}}{2}ay_{11}\,\mathbf{\hat{y}} + \frac{1}{3}c\left(3z_{11}+2\right)\,\mathbf{\hat{z}}$	(12k)	O IV
$\mathbf{B_{79}}$	=	$y_{11}\,\mathbf{a}_{1} + x_{11}\,\mathbf{a}_{2} - \left(z_{11} - \frac{1}{3}\right)\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(x_{11}+y_{11}\right)\,\mathbf{\hat{x}} + \frac{\sqrt{3}}{2}a\left(x_{11}-y_{11}\right)\,\mathbf{\hat{y}} - c\left(z_{11} - \frac{1}{3}\right)\,\mathbf{\hat{z}}$	(12k)	O IV
$\mathbf{B_{80}}$	=	$\left(x_{11}-y_{11}\right)\,\mathbf{a}_{1} - y_{11}\,\mathbf{a}_{2} - z_{11}\,\mathbf{a}_{3}$	=	$\frac{1}{2}a\left(x_{11}-2y_{11}\right)\,\mathbf{\hat{x}} - \frac{\sqrt{3}}{2}ax_{11}\,\mathbf{\hat{y}} - cz_{11}\,\mathbf{\hat{z}}$	(12k)	O IV

$\mathbf{B_{81}}$	=	$-x_{11}\,\mathbf{a}_1 - \left(x_{11} - y_{11}\right)\,\mathbf{a}_2 - \left(z_{11} - \frac{2}{3}\right)\,\mathbf{a}_3$	=	$-\frac{1}{2}a\left(2x_{11} - y_{11}\right)\,\mathbf{\hat{x}} + \frac{\sqrt{3}}{2}ay_{11}\,\mathbf{\hat{y}} - \frac{1}{3}c\left(3z_{11} - 2\right)\,\mathbf{\hat{z}}$	(12k)	O IV
$\mathbf{B_{82}}$	=	$-y_{11}\,\mathbf{a}_1 - x_{11}\,\mathbf{a}_2 - \left(z_{11} - \frac{1}{3}\right)\,\mathbf{a}_3$	=	$-\frac{1}{2}a\left(x_{11} + y_{11}\right)\,\mathbf{\hat{x}} - \frac{\sqrt{3}}{2}a\left(x_{11} - y_{11}\right)\,\mathbf{\hat{y}} - c\left(z_{11} - \frac{1}{3}\right)\,\mathbf{\hat{z}}$	(12k)	O IV
$\mathbf{B_{83}}$	=	$-\left(x_{11} - y_{11}\right)\,\mathbf{a}_1 + y_{11}\,\mathbf{a}_2 - z_{11}\,\mathbf{a}_3$	=	$\frac{1}{2}a\left(-x_{11} + 2y_{11}\right)\,\mathbf{\hat{x}} + \frac{\sqrt{3}}{2}ax_{11}\,\mathbf{\hat{y}} - cz_{11}\,\mathbf{\hat{z}}$	(12k)	O IV
$\mathbf{B_{84}}$	=	$x_{11}\,\mathbf{a}_1 + \left(x_{11} - y_{11}\right)\,\mathbf{a}_2 - \left(z_{11} - \frac{2}{3}\right)\,\mathbf{a}_3$	=	$\frac{1}{2}a\left(2x_{11} - y_{11}\right)\,\mathbf{\hat{x}} - \frac{\sqrt{3}}{2}ay_{11}\,\mathbf{\hat{y}} - \frac{1}{3}c\left(3z_{11} - 2\right)\,\mathbf{\hat{z}}$	(12k)	O IV

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