

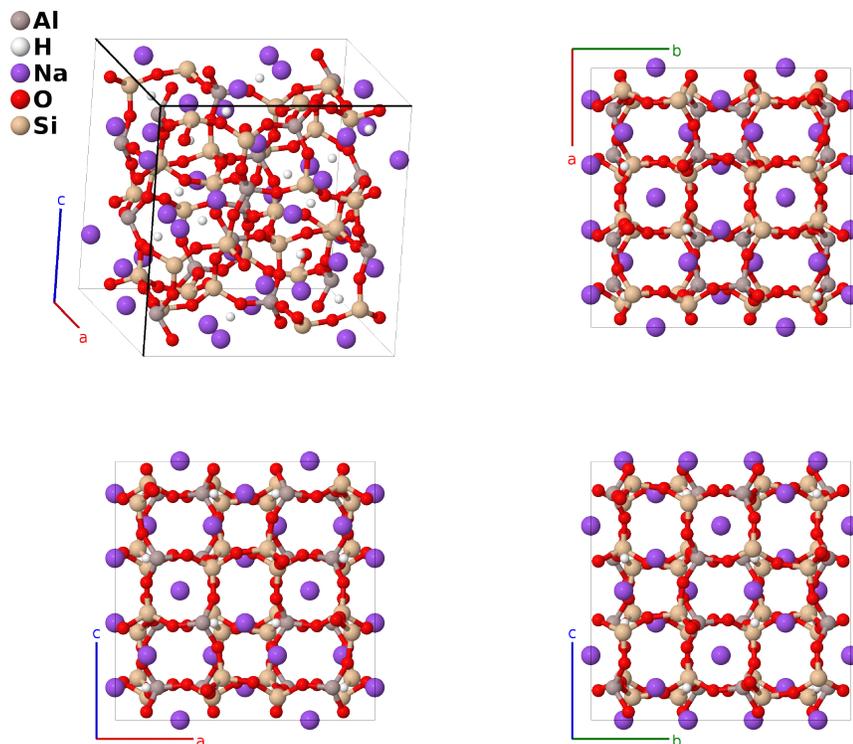
# Analcime ( $\text{NaAlSi}_2\text{O}_6 \cdot \text{H}_2\text{O}$ , $S6_1$ ) Structure: A2B2C3D12E4\_tI184\_142\_f\_f\_be\_3g\_g-001

This structure originally had the label `A2B2C3D12E4_tI184_142_f_f_be_3g_g`. Calls to that address will be redirected here.

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<https://aflow.org/p/PFBA>

[https://aflow.org/p/A2B2C3D12E4\\_tI184\\_142\\_f\\_f\\_be\\_3g\\_g-001](https://aflow.org/p/A2B2C3D12E4_tI184_142_f_f_be_3g_g-001)



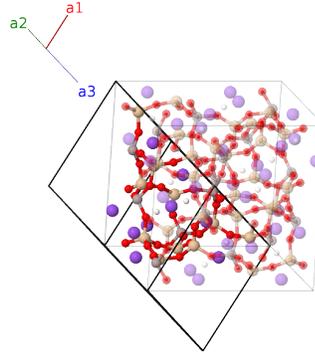
Prototype	$\text{AlH}_2\text{NaO}_7\text{Si}_2$
AFLOW prototype label	A2B2C3D12E4_tI184_142_f_f_be_3g_g-001
<i>Strukturbericht</i> designation	$S6_1$
Mineral name	analcime
ICSD	34874
Pearson symbol	tI184
Space group number	142
Space group symbol	$I4_1/acd$
AFLOW prototype command	<code>aflow --proto=A2B2C3D12E4_tI184_142_f_f_be_3g_g-001</code> <code>--params=a, c/a, x<sub>2</sub>, x<sub>3</sub>, x<sub>4</sub>, x<sub>5</sub>, y<sub>5</sub>, z<sub>5</sub>, x<sub>6</sub>, y<sub>6</sub>, z<sub>6</sub>, x<sub>7</sub>, y<sub>7</sub>, z<sub>7</sub>, x<sub>8</sub>, y<sub>8</sub>, z<sub>8</sub></code>

- Analcime is pseudo-cubic, space group  $Ia\bar{3}d$  #230, but (Hartwig, 1931) showed that the structure actually is tetragonal, space group  $I4_1/acd$  #142. (Hermann, 1937) listed both structures in defining *Strukturbericht* type  $S6_1$ .
- Analcime can have many crystal structures as found in, *e.g.*, (Mazzi, 1978) and (Pechar, 1988). We take our prototype from (Mazzi, 1978), using the data from there sample ANA 1, which is in space group  $I4_1/acd$  #142. The major difference between this structure and that found by (Hartwig, 1931) is that sodium atoms were found at the (8b) Wyckoff position (Na-I). (Mazzi, 1978) recover the stoichiometry by noting that site Na-I (8b) is only occupied 23% of the time, while site Na-II (16e) has 82% occupancy. In addition, our Si site (32e) is actually 47% aluminum and 53% silicon, and the site which we, following (Hartwig, 1931), label Al (16f) is actually 98% silicon and only 2% aluminum. These fractions are highly dependent upon the choice of sample.
- Removing all sodium from the (8b) site results in the original structure found by (Hartwig, 1931) and defined as  $S6_1$  by (Hermann, 1937).
- The positions of the hydrogen atoms in the water molecules were not determined, so we only provide the positions of the oxygen atoms (labeled as H<sub>2</sub>O).

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### Body-centered Tetragonal primitive vectors

$$\begin{aligned}\mathbf{a}_1 &= -\frac{1}{2}a\hat{\mathbf{x}} + \frac{1}{2}a\hat{\mathbf{y}} + \frac{1}{2}c\hat{\mathbf{z}} \\ \mathbf{a}_2 &= \frac{1}{2}a\hat{\mathbf{x}} - \frac{1}{2}a\hat{\mathbf{y}} + \frac{1}{2}c\hat{\mathbf{z}} \\ \mathbf{a}_3 &= \frac{1}{2}a\hat{\mathbf{x}} + \frac{1}{2}a\hat{\mathbf{y}} - \frac{1}{2}c\hat{\mathbf{z}}\end{aligned}$$




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### Basis vectors

	Lattice coordinates		Cartesian coordinates	Wyckoff position	Atom type
$\mathbf{B}_1$	$= \frac{3}{8}\mathbf{a}_1 + \frac{1}{8}\mathbf{a}_2 + \frac{1}{4}\mathbf{a}_3$	$=$	$\frac{1}{4}a\hat{\mathbf{y}} + \frac{1}{8}c\hat{\mathbf{z}}$	(8b)	Na I
$\mathbf{B}_2$	$= \frac{1}{8}\mathbf{a}_1 + \frac{3}{8}\mathbf{a}_2 + \frac{3}{4}\mathbf{a}_3$	$=$	$\frac{1}{2}a\hat{\mathbf{x}} + \frac{1}{4}a\hat{\mathbf{y}} - \frac{1}{8}c\hat{\mathbf{z}}$	(8b)	Na I
$\mathbf{B}_3$	$= \frac{5}{8}\mathbf{a}_1 + \frac{7}{8}\mathbf{a}_2 + \frac{3}{4}\mathbf{a}_3$	$=$	$\frac{1}{2}a\hat{\mathbf{x}} + \frac{1}{4}a\hat{\mathbf{y}} + \frac{3}{8}c\hat{\mathbf{z}}$	(8b)	Na I
$\mathbf{B}_4$	$= \frac{7}{8}\mathbf{a}_1 + \frac{5}{8}\mathbf{a}_2 + \frac{1}{4}\mathbf{a}_3$	$=$	$\frac{1}{4}a\hat{\mathbf{y}} + \frac{5}{8}c\hat{\mathbf{z}}$	(8b)	Na I
$\mathbf{B}_5$	$= \frac{1}{4}\mathbf{a}_1 + (x_2 + \frac{1}{4})\mathbf{a}_2 + x_2\mathbf{a}_3$	$=$	$ax_2\hat{\mathbf{x}} + \frac{1}{4}c\hat{\mathbf{z}}$	(16e)	Na II
$\mathbf{B}_6$	$= \frac{3}{4}\mathbf{a}_1 - (x_2 - \frac{1}{4})\mathbf{a}_2 - (x_2 - \frac{1}{2})\mathbf{a}_3$	$=$	$-ax_2\hat{\mathbf{x}} + \frac{1}{2}a\hat{\mathbf{y}} + \frac{1}{4}c\hat{\mathbf{z}}$	(16e)	Na II
$\mathbf{B}_7$	$= (x_2 + \frac{1}{4})\mathbf{a}_1 + \frac{3}{4}\mathbf{a}_2 + x_2\mathbf{a}_3$	$=$	$\frac{1}{4}a\hat{\mathbf{x}} + a(x_2 - \frac{1}{4})\hat{\mathbf{y}} + \frac{1}{2}c\hat{\mathbf{z}}$	(16e)	Na II
$\mathbf{B}_8$	$= -(x_2 - \frac{1}{4})\mathbf{a}_1 + \frac{1}{4}\mathbf{a}_2 - (x_2 - \frac{1}{2})\mathbf{a}_3$	$=$	$\frac{1}{4}a\hat{\mathbf{x}} - a(x_2 - \frac{1}{4})\hat{\mathbf{y}}$	(16e)	Na II
$\mathbf{B}_9$	$= \frac{3}{4}\mathbf{a}_1 - (x_2 - \frac{3}{4})\mathbf{a}_2 - x_2\mathbf{a}_3$	$=$	$-ax_2\hat{\mathbf{x}} + \frac{3}{4}c\hat{\mathbf{z}}$	(16e)	Na II
$\mathbf{B}_{10}$	$= \frac{1}{4}\mathbf{a}_1 + (x_2 + \frac{3}{4})\mathbf{a}_2 + (x_2 + \frac{1}{2})\mathbf{a}_3$	$=$	$a(x_2 + \frac{1}{2})\hat{\mathbf{x}} + \frac{1}{4}c\hat{\mathbf{z}}$	(16e)	Na II
$\mathbf{B}_{11}$	$= -(x_2 - \frac{3}{4})\mathbf{a}_1 + \frac{1}{4}\mathbf{a}_2 - x_2\mathbf{a}_3$	$=$	$-\frac{1}{4}a\hat{\mathbf{x}} - a(x_2 - \frac{1}{4})\hat{\mathbf{y}} + \frac{1}{2}c\hat{\mathbf{z}}$	(16e)	Na II
$\mathbf{B}_{12}$	$= (x_2 + \frac{3}{4})\mathbf{a}_1 + \frac{3}{4}\mathbf{a}_2 + (x_2 + \frac{1}{2})\mathbf{a}_3$	$=$	$\frac{1}{4}a\hat{\mathbf{x}} + a(x_2 + \frac{1}{4})\hat{\mathbf{y}} + \frac{1}{2}c\hat{\mathbf{z}}$	(16e)	Na II
$\mathbf{B}_{13}$	$= (x_3 + \frac{3}{8})\mathbf{a}_1 + (x_3 + \frac{1}{8})\mathbf{a}_2 + (2x_3 + \frac{1}{4})\mathbf{a}_3$	$=$	$ax_3\hat{\mathbf{x}} + a(x_3 + \frac{1}{4})\hat{\mathbf{y}} + \frac{1}{8}c\hat{\mathbf{z}}$	(16f)	Al I
$\mathbf{B}_{14}$	$= -(x_3 - \frac{3}{8})\mathbf{a}_1 - (x_3 - \frac{1}{8})\mathbf{a}_2 - (2x_3 - \frac{1}{4})\mathbf{a}_3$	$=$	$-ax_3\hat{\mathbf{x}} - a(x_3 - \frac{1}{4})\hat{\mathbf{y}} + \frac{1}{8}c\hat{\mathbf{z}}$	(16f)	Al I
$\mathbf{B}_{15}$	$= (x_3 + \frac{1}{8})\mathbf{a}_1 - (x_3 - \frac{3}{8})\mathbf{a}_2 + \frac{3}{4}\mathbf{a}_3$	$=$	$-a(x_3 - \frac{1}{2})\hat{\mathbf{x}} + a(x_3 + \frac{1}{4})\hat{\mathbf{y}} - \frac{1}{8}c\hat{\mathbf{z}}$	(16f)	Al I



$$\begin{aligned}
\mathbf{B}_{40} &= (x_5 - z_5) \mathbf{a}_1 - (y_5 + z_5) \mathbf{a}_2 + (x_5 - y_5 + \frac{1}{2}) \mathbf{a}_3 = -a(y_5 - \frac{1}{4}) \hat{\mathbf{x}} + a(x_5 + \frac{1}{4}) \hat{\mathbf{y}} - c(z_5 + \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O I} \\
\mathbf{B}_{41} &= -(y_5 - z_5) \mathbf{a}_1 + (x_5 + z_5 + \frac{1}{2}) \mathbf{a}_2 + (x_5 - y_5 + \frac{1}{2}) \mathbf{a}_3 = a(x_5 + \frac{1}{2}) \hat{\mathbf{x}} - ay_5 \hat{\mathbf{y}} + cz_5 \hat{\mathbf{z}} & (32g) & \text{O I} \\
\mathbf{B}_{42} &= (y_5 + z_5 + \frac{1}{2}) \mathbf{a}_1 + (-x_5 + z_5 + \frac{1}{2}) \mathbf{a}_2 - (x_5 - y_5) \mathbf{a}_3 = -ax_5 \hat{\mathbf{x}} + ay_5 \hat{\mathbf{y}} + c(z_5 + \frac{1}{2}) \hat{\mathbf{z}} & (32g) & \text{O I} \\
\mathbf{B}_{43} &= (-x_5 + z_5 + \frac{1}{2}) \mathbf{a}_1 - (y_5 - z_5) \mathbf{a}_2 - (x_5 + y_5) \mathbf{a}_3 = -a(y_5 + \frac{1}{4}) \hat{\mathbf{x}} - a(x_5 - \frac{1}{4}) \hat{\mathbf{y}} + c(z_5 + \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O I} \\
\mathbf{B}_{44} &= (x_5 + z_5 + \frac{1}{2}) \mathbf{a}_1 + (y_5 + z_5 + \frac{1}{2}) \mathbf{a}_2 + (x_5 + y_5 + \frac{1}{2}) \mathbf{a}_3 = a(y_5 + \frac{1}{4}) \hat{\mathbf{x}} + a(x_5 + \frac{1}{4}) \hat{\mathbf{y}} + c(z_5 + \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O I} \\
\mathbf{B}_{45} &= (y_6 + z_6) \mathbf{a}_1 + (x_6 + z_6) \mathbf{a}_2 + (x_6 + y_6) \mathbf{a}_3 = ax_6 \hat{\mathbf{x}} + ay_6 \hat{\mathbf{y}} + cz_6 \hat{\mathbf{z}} & (32g) & \text{O II} \\
\mathbf{B}_{46} &= (-y_6 + z_6 + \frac{1}{2}) \mathbf{a}_1 - (x_6 - z_6) \mathbf{a}_2 - (x_6 + y_6 - \frac{1}{2}) \mathbf{a}_3 = -ax_6 \hat{\mathbf{x}} - a(y_6 - \frac{1}{2}) \hat{\mathbf{y}} + cz_6 \hat{\mathbf{z}} & (32g) & \text{O II} \\
\mathbf{B}_{47} &= (x_6 + z_6) \mathbf{a}_1 + (-y_6 + z_6 + \frac{1}{2}) \mathbf{a}_2 + (x_6 - y_6) \mathbf{a}_3 = -a(y_6 - \frac{1}{4}) \hat{\mathbf{x}} + a(x_6 - \frac{1}{4}) \hat{\mathbf{y}} + c(z_6 + \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O II} \\
\mathbf{B}_{48} &= -(x_6 - z_6) \mathbf{a}_1 + (y_6 + z_6) \mathbf{a}_2 + (-x_6 + y_6 + \frac{1}{2}) \mathbf{a}_3 = a(y_6 + \frac{1}{4}) \hat{\mathbf{x}} - a(x_6 - \frac{1}{4}) \hat{\mathbf{y}} + c(z_6 - \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O II} \\
\mathbf{B}_{49} &= (y_6 - z_6) \mathbf{a}_1 - (x_6 + z_6 - \frac{1}{2}) \mathbf{a}_2 + (-x_6 + y_6 + \frac{1}{2}) \mathbf{a}_3 = -a(x_6 - \frac{1}{2}) \hat{\mathbf{x}} + ay_6 \hat{\mathbf{y}} - cz_6 \hat{\mathbf{z}} & (32g) & \text{O II} \\
\mathbf{B}_{50} &= -(y_6 + z_6 - \frac{1}{2}) \mathbf{a}_1 + (x_6 - z_6 + \frac{1}{2}) \mathbf{a}_2 + (x_6 - y_6) \mathbf{a}_3 = ax_6 \hat{\mathbf{x}} - ay_6 \hat{\mathbf{y}} - c(z_6 - \frac{1}{2}) \hat{\mathbf{z}} & (32g) & \text{O II} \\
\mathbf{B}_{51} &= (x_6 - z_6 + \frac{1}{2}) \mathbf{a}_1 + (y_6 - z_6) \mathbf{a}_2 + (x_6 + y_6) \mathbf{a}_3 = a(y_6 - \frac{1}{4}) \hat{\mathbf{x}} + a(x_6 + \frac{1}{4}) \hat{\mathbf{y}} - c(z_6 - \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O II} \\
\mathbf{B}_{52} &= -(x_6 + z_6 - \frac{1}{2}) \mathbf{a}_1 - (y_6 + z_6 - \frac{1}{2}) \mathbf{a}_2 - (x_6 + y_6 - \frac{1}{2}) \mathbf{a}_3 = -a(y_6 - \frac{1}{4}) \hat{\mathbf{x}} - a(x_6 - \frac{1}{4}) \hat{\mathbf{y}} - c(z_6 - \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O II} \\
\mathbf{B}_{53} &= -(y_6 + z_6) \mathbf{a}_1 - (x_6 + z_6) \mathbf{a}_2 - (x_6 + y_6) \mathbf{a}_3 = -ax_6 \hat{\mathbf{x}} - ay_6 \hat{\mathbf{y}} - cz_6 \hat{\mathbf{z}} & (32g) & \text{O II} \\
\mathbf{B}_{54} &= (y_6 - z_6 + \frac{1}{2}) \mathbf{a}_1 + (x_6 - z_6) \mathbf{a}_2 + (x_6 + y_6 + \frac{1}{2}) \mathbf{a}_3 = ax_6 \hat{\mathbf{x}} + a(y_6 + \frac{1}{2}) \hat{\mathbf{y}} - cz_6 \hat{\mathbf{z}} & (32g) & \text{O II} \\
\mathbf{B}_{55} &= -(x_6 + z_6) \mathbf{a}_1 + (y_6 - z_6 + \frac{1}{2}) \mathbf{a}_2 - (x_6 - y_6) \mathbf{a}_3 = a(y_6 + \frac{1}{4}) \hat{\mathbf{x}} - a(x_6 + \frac{1}{4}) \hat{\mathbf{y}} - c(z_6 - \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O II} \\
\mathbf{B}_{56} &= (x_6 - z_6) \mathbf{a}_1 - (y_6 + z_6) \mathbf{a}_2 + (x_6 - y_6 + \frac{1}{2}) \mathbf{a}_3 = -a(y_6 - \frac{1}{4}) \hat{\mathbf{x}} + a(x_6 + \frac{1}{4}) \hat{\mathbf{y}} - c(z_6 + \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O II} \\
\mathbf{B}_{57} &= -(y_6 - z_6) \mathbf{a}_1 + (x_6 + z_6 + \frac{1}{2}) \mathbf{a}_2 + (x_6 - y_6 + \frac{1}{2}) \mathbf{a}_3 = a(x_6 + \frac{1}{2}) \hat{\mathbf{x}} - ay_6 \hat{\mathbf{y}} + cz_6 \hat{\mathbf{z}} & (32g) & \text{O II} \\
\mathbf{B}_{58} &= (y_6 + z_6 + \frac{1}{2}) \mathbf{a}_1 + (-x_6 + z_6 + \frac{1}{2}) \mathbf{a}_2 - (x_6 - y_6) \mathbf{a}_3 = -ax_6 \hat{\mathbf{x}} + ay_6 \hat{\mathbf{y}} + c(z_6 + \frac{1}{2}) \hat{\mathbf{z}} & (32g) & \text{O II} \\
\mathbf{B}_{59} &= (-x_6 + z_6 + \frac{1}{2}) \mathbf{a}_1 - (y_6 - z_6) \mathbf{a}_2 - (x_6 + y_6) \mathbf{a}_3 = -a(y_6 + \frac{1}{4}) \hat{\mathbf{x}} - a(x_6 - \frac{1}{4}) \hat{\mathbf{y}} + c(z_6 + \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O II} \\
\mathbf{B}_{60} &= (x_6 + z_6 + \frac{1}{2}) \mathbf{a}_1 + (y_6 + z_6 + \frac{1}{2}) \mathbf{a}_2 + (x_6 + y_6 + \frac{1}{2}) \mathbf{a}_3 = a(y_6 + \frac{1}{4}) \hat{\mathbf{x}} + a(x_6 + \frac{1}{4}) \hat{\mathbf{y}} + c(z_6 + \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O II}
\end{aligned}$$

$$\begin{aligned}
\mathbf{B}_{61} &= (y_7 + z_7) \mathbf{a}_1 + (x_7 + z_7) \mathbf{a}_2 + (x_7 + y_7) \mathbf{a}_3 &= ax_7 \hat{\mathbf{x}} + ay_7 \hat{\mathbf{y}} + cz_7 \hat{\mathbf{z}} & (32g) & \text{O III} \\
\mathbf{B}_{62} &= (-y_7 + z_7 + \frac{1}{2}) \mathbf{a}_1 - (x_7 - z_7) \mathbf{a}_2 - (x_7 + y_7 - \frac{1}{2}) \mathbf{a}_3 &= -ax_7 \hat{\mathbf{x}} - a(y_7 - \frac{1}{2}) \hat{\mathbf{y}} + cz_7 \hat{\mathbf{z}} & (32g) & \text{O III} \\
\mathbf{B}_{63} &= (x_7 + z_7) \mathbf{a}_1 + (-y_7 + z_7 + \frac{1}{2}) \mathbf{a}_2 + (x_7 - y_7) \mathbf{a}_3 &= -a(y_7 - \frac{1}{4}) \hat{\mathbf{x}} + a(x_7 - \frac{1}{4}) \hat{\mathbf{y}} + c(z_7 + \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O III} \\
\mathbf{B}_{64} &= -(x_7 - z_7) \mathbf{a}_1 + (y_7 + z_7) \mathbf{a}_2 + (-x_7 + y_7 + \frac{1}{2}) \mathbf{a}_3 &= a(y_7 + \frac{1}{4}) \hat{\mathbf{x}} - a(x_7 - \frac{1}{4}) \hat{\mathbf{y}} + c(z_7 - \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O III} \\
\mathbf{B}_{65} &= (y_7 - z_7) \mathbf{a}_1 - (x_7 + z_7 - \frac{1}{2}) \mathbf{a}_2 + (-x_7 + y_7 + \frac{1}{2}) \mathbf{a}_3 &= -a(x_7 - \frac{1}{2}) \hat{\mathbf{x}} + ay_7 \hat{\mathbf{y}} - cz_7 \hat{\mathbf{z}} & (32g) & \text{O III} \\
\mathbf{B}_{66} &= -(y_7 + z_7 - \frac{1}{2}) \mathbf{a}_1 + (x_7 - z_7 + \frac{1}{2}) \mathbf{a}_2 + (x_7 - y_7) \mathbf{a}_3 &= ax_7 \hat{\mathbf{x}} - ay_7 \hat{\mathbf{y}} - c(z_7 - \frac{1}{2}) \hat{\mathbf{z}} & (32g) & \text{O III} \\
\mathbf{B}_{67} &= (x_7 - z_7 + \frac{1}{2}) \mathbf{a}_1 + (y_7 - z_7) \mathbf{a}_2 + (x_7 + y_7) \mathbf{a}_3 &= a(y_7 - \frac{1}{4}) \hat{\mathbf{x}} + a(x_7 + \frac{1}{4}) \hat{\mathbf{y}} - c(z_7 - \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O III} \\
\mathbf{B}_{68} &= -(x_7 + z_7 - \frac{1}{2}) \mathbf{a}_1 - (y_7 + z_7 - \frac{1}{2}) \mathbf{a}_2 - (x_7 + y_7 - \frac{1}{2}) \mathbf{a}_3 &= -a(y_7 - \frac{1}{4}) \hat{\mathbf{x}} - a(x_7 - \frac{1}{4}) \hat{\mathbf{y}} - c(z_7 - \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O III} \\
\mathbf{B}_{69} &= -(y_7 + z_7) \mathbf{a}_1 - (x_7 + z_7) \mathbf{a}_2 - (x_7 + y_7) \mathbf{a}_3 &= -ax_7 \hat{\mathbf{x}} - ay_7 \hat{\mathbf{y}} - cz_7 \hat{\mathbf{z}} & (32g) & \text{O III} \\
\mathbf{B}_{70} &= (y_7 - z_7 + \frac{1}{2}) \mathbf{a}_1 + (x_7 - z_7) \mathbf{a}_2 + (x_7 + y_7 + \frac{1}{2}) \mathbf{a}_3 &= ax_7 \hat{\mathbf{x}} + a(y_7 + \frac{1}{2}) \hat{\mathbf{y}} - cz_7 \hat{\mathbf{z}} & (32g) & \text{O III} \\
\mathbf{B}_{71} &= -(x_7 + z_7) \mathbf{a}_1 + (y_7 - z_7 + \frac{1}{2}) \mathbf{a}_2 - (x_7 - y_7) \mathbf{a}_3 &= a(y_7 + \frac{1}{4}) \hat{\mathbf{x}} - a(x_7 + \frac{1}{4}) \hat{\mathbf{y}} - c(z_7 - \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O III} \\
\mathbf{B}_{72} &= (x_7 - z_7) \mathbf{a}_1 - (y_7 + z_7) \mathbf{a}_2 + (x_7 - y_7 + \frac{1}{2}) \mathbf{a}_3 &= -a(y_7 - \frac{1}{4}) \hat{\mathbf{x}} + a(x_7 + \frac{1}{4}) \hat{\mathbf{y}} - c(z_7 + \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O III} \\
\mathbf{B}_{73} &= -(y_7 - z_7) \mathbf{a}_1 + (x_7 + z_7 + \frac{1}{2}) \mathbf{a}_2 + (x_7 - y_7 + \frac{1}{2}) \mathbf{a}_3 &= a(x_7 + \frac{1}{2}) \hat{\mathbf{x}} - ay_7 \hat{\mathbf{y}} + cz_7 \hat{\mathbf{z}} & (32g) & \text{O III} \\
\mathbf{B}_{74} &= (y_7 + z_7 + \frac{1}{2}) \mathbf{a}_1 + (-x_7 + z_7 + \frac{1}{2}) \mathbf{a}_2 - (x_7 - y_7) \mathbf{a}_3 &= -ax_7 \hat{\mathbf{x}} + ay_7 \hat{\mathbf{y}} + c(z_7 + \frac{1}{2}) \hat{\mathbf{z}} & (32g) & \text{O III} \\
\mathbf{B}_{75} &= (-x_7 + z_7 + \frac{1}{2}) \mathbf{a}_1 - (y_7 - z_7) \mathbf{a}_2 - (x_7 + y_7) \mathbf{a}_3 &= -a(y_7 + \frac{1}{4}) \hat{\mathbf{x}} - a(x_7 - \frac{1}{4}) \hat{\mathbf{y}} + c(z_7 + \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O III} \\
\mathbf{B}_{76} &= (x_7 + z_7 + \frac{1}{2}) \mathbf{a}_1 + (y_7 + z_7 + \frac{1}{2}) \mathbf{a}_2 + (x_7 + y_7 + \frac{1}{2}) \mathbf{a}_3 &= a(y_7 + \frac{1}{4}) \hat{\mathbf{x}} + a(x_7 + \frac{1}{4}) \hat{\mathbf{y}} + c(z_7 + \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{O III} \\
\mathbf{B}_{77} &= (y_8 + z_8) \mathbf{a}_1 + (x_8 + z_8) \mathbf{a}_2 + (x_8 + y_8) \mathbf{a}_3 &= ax_8 \hat{\mathbf{x}} + ay_8 \hat{\mathbf{y}} + cz_8 \hat{\mathbf{z}} & (32g) & \text{Si I} \\
\mathbf{B}_{78} &= (-y_8 + z_8 + \frac{1}{2}) \mathbf{a}_1 - (x_8 - z_8) \mathbf{a}_2 - (x_8 + y_8 - \frac{1}{2}) \mathbf{a}_3 &= -ax_8 \hat{\mathbf{x}} - a(y_8 - \frac{1}{2}) \hat{\mathbf{y}} + cz_8 \hat{\mathbf{z}} & (32g) & \text{Si I} \\
\mathbf{B}_{79} &= (x_8 + z_8) \mathbf{a}_1 + (-y_8 + z_8 + \frac{1}{2}) \mathbf{a}_2 + (x_8 - y_8) \mathbf{a}_3 &= -a(y_8 - \frac{1}{4}) \hat{\mathbf{x}} + a(x_8 - \frac{1}{4}) \hat{\mathbf{y}} + c(z_8 + \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{Si I} \\
\mathbf{B}_{80} &= -(x_8 - z_8) \mathbf{a}_1 + (y_8 + z_8) \mathbf{a}_2 + (-x_8 + y_8 + \frac{1}{2}) \mathbf{a}_3 &= a(y_8 + \frac{1}{4}) \hat{\mathbf{x}} - a(x_8 - \frac{1}{4}) \hat{\mathbf{y}} + c(z_8 - \frac{1}{4}) \hat{\mathbf{z}} & (32g) & \text{Si I} \\
\mathbf{B}_{81} &= (y_8 - z_8) \mathbf{a}_1 - (x_8 + z_8 - \frac{1}{2}) \mathbf{a}_2 + (-x_8 + y_8 + \frac{1}{2}) \mathbf{a}_3 &= -a(x_8 - \frac{1}{2}) \hat{\mathbf{x}} + ay_8 \hat{\mathbf{y}} - cz_8 \hat{\mathbf{z}} & (32g) & \text{Si I} \\
\mathbf{B}_{82} &= -(y_8 + z_8 - \frac{1}{2}) \mathbf{a}_1 + (x_8 - z_8 + \frac{1}{2}) \mathbf{a}_2 + (x_8 - y_8) \mathbf{a}_3 &= ax_8 \hat{\mathbf{x}} - ay_8 \hat{\mathbf{y}} - c(z_8 - \frac{1}{2}) \hat{\mathbf{z}} & (32g) & \text{Si I}
\end{aligned}$$

$$\begin{aligned}
\mathbf{B}_{83} &= \begin{pmatrix} (x_8 - z_8 + \frac{1}{2}) \mathbf{a}_1 + \\ (y_8 - z_8) \mathbf{a}_2 + (x_8 + y_8) \mathbf{a}_3 \end{pmatrix} = a \left( y_8 - \frac{1}{4} \right) \hat{\mathbf{x}} + a \left( x_8 + \frac{1}{4} \right) \hat{\mathbf{y}} - c \left( z_8 - \frac{1}{4} \right) \hat{\mathbf{z}} & (32g) & \text{Si I} \\
\mathbf{B}_{84} &= \begin{pmatrix} - (x_8 + z_8 - \frac{1}{2}) \mathbf{a}_1 - \\ (y_8 + z_8 - \frac{1}{2}) \mathbf{a}_2 - \\ (x_8 + y_8 - \frac{1}{2}) \mathbf{a}_3 \end{pmatrix} = -a \left( y_8 - \frac{1}{4} \right) \hat{\mathbf{x}} - a \left( x_8 - \frac{1}{4} \right) \hat{\mathbf{y}} - c \left( z_8 - \frac{1}{4} \right) \hat{\mathbf{z}} & (32g) & \text{Si I} \\
\mathbf{B}_{85} &= \begin{pmatrix} - (y_8 + z_8) \mathbf{a}_1 - (x_8 + z_8) \mathbf{a}_2 - \\ (x_8 + y_8) \mathbf{a}_3 \end{pmatrix} = -ax_8 \hat{\mathbf{x}} - ay_8 \hat{\mathbf{y}} - cz_8 \hat{\mathbf{z}} & (32g) & \text{Si I} \\
\mathbf{B}_{86} &= \begin{pmatrix} (y_8 - z_8 + \frac{1}{2}) \mathbf{a}_1 + \\ (x_8 - z_8) \mathbf{a}_2 + (x_8 + y_8 + \frac{1}{2}) \mathbf{a}_3 \end{pmatrix} = ax_8 \hat{\mathbf{x}} + a \left( y_8 + \frac{1}{2} \right) \hat{\mathbf{y}} - cz_8 \hat{\mathbf{z}} & (32g) & \text{Si I} \\
\mathbf{B}_{87} &= \begin{pmatrix} - (x_8 + z_8) \mathbf{a}_1 + \\ (y_8 - z_8 + \frac{1}{2}) \mathbf{a}_2 - (x_8 - y_8) \mathbf{a}_3 \end{pmatrix} = a \left( y_8 + \frac{1}{4} \right) \hat{\mathbf{x}} - a \left( x_8 + \frac{1}{4} \right) \hat{\mathbf{y}} - c \left( z_8 - \frac{1}{4} \right) \hat{\mathbf{z}} & (32g) & \text{Si I} \\
\mathbf{B}_{88} &= \begin{pmatrix} (x_8 - z_8) \mathbf{a}_1 - (y_8 + z_8) \mathbf{a}_2 + \\ (x_8 - y_8 + \frac{1}{2}) \mathbf{a}_3 \end{pmatrix} = -a \left( y_8 - \frac{1}{4} \right) \hat{\mathbf{x}} + a \left( x_8 + \frac{1}{4} \right) \hat{\mathbf{y}} - c \left( z_8 + \frac{1}{4} \right) \hat{\mathbf{z}} & (32g) & \text{Si I} \\
\mathbf{B}_{89} &= \begin{pmatrix} - (y_8 - z_8) \mathbf{a}_1 + \\ (x_8 + z_8 + \frac{1}{2}) \mathbf{a}_2 + \\ (x_8 - y_8 + \frac{1}{2}) \mathbf{a}_3 \end{pmatrix} = a \left( x_8 + \frac{1}{2} \right) \hat{\mathbf{x}} - ay_8 \hat{\mathbf{y}} + cz_8 \hat{\mathbf{z}} & (32g) & \text{Si I} \\
\mathbf{B}_{90} &= \begin{pmatrix} (y_8 + z_8 + \frac{1}{2}) \mathbf{a}_1 + \\ (-x_8 + z_8 + \frac{1}{2}) \mathbf{a}_2 - (x_8 - y_8) \mathbf{a}_3 \end{pmatrix} = -ax_8 \hat{\mathbf{x}} + ay_8 \hat{\mathbf{y}} + c \left( z_8 + \frac{1}{2} \right) \hat{\mathbf{z}} & (32g) & \text{Si I} \\
\mathbf{B}_{91} &= \begin{pmatrix} (-x_8 + z_8 + \frac{1}{2}) \mathbf{a}_1 - \\ (y_8 - z_8) \mathbf{a}_2 - (x_8 + y_8) \mathbf{a}_3 \end{pmatrix} = -a \left( y_8 + \frac{1}{4} \right) \hat{\mathbf{x}} - a \left( x_8 - \frac{1}{4} \right) \hat{\mathbf{y}} + c \left( z_8 + \frac{1}{4} \right) \hat{\mathbf{z}} & (32g) & \text{Si I} \\
\mathbf{B}_{92} &= \begin{pmatrix} (x_8 + z_8 + \frac{1}{2}) \mathbf{a}_1 + \\ (y_8 + z_8 + \frac{1}{2}) \mathbf{a}_2 + \\ (x_8 + y_8 + \frac{1}{2}) \mathbf{a}_3 \end{pmatrix} = a \left( y_8 + \frac{1}{4} \right) \hat{\mathbf{x}} + a \left( x_8 + \frac{1}{4} \right) \hat{\mathbf{y}} + c \left( z_8 + \frac{1}{4} \right) \hat{\mathbf{z}} & (32g) & \text{Si I}
\end{aligned}$$

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