# $\beta$-Alum [$Al(NH_3CH_3)_2(SO_4)_2 \cdot 12H_2O$, $H4_{14}$] Structure: AB2C36D2E20F2_cP252_205_a_c_6d_c_c3d_c-001

This structure originally had the label `AB2C36D2E20F2_cP252_205_a_c_6d_c_c3d_c`. Calls to that address will be redirected here.

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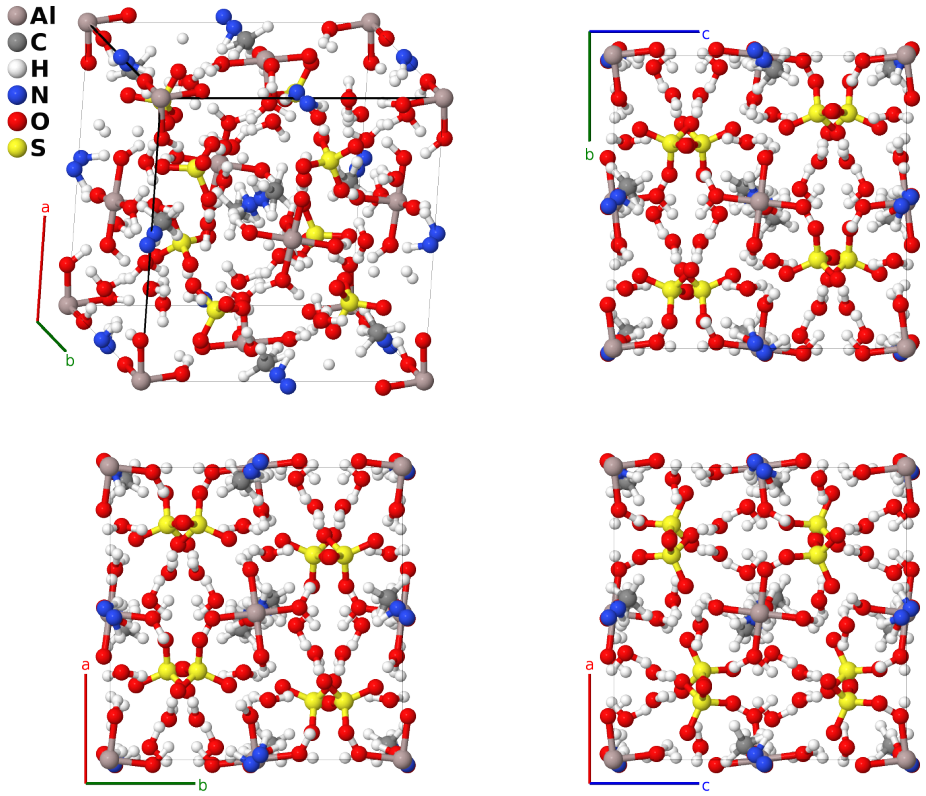
https://aflow.org/p/SFC7

https://aflow.org/p/AB2C36D2E20F2_cP252_205_a_c_6d_c_c3d_c-001



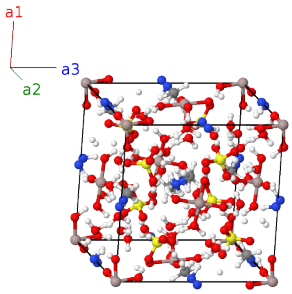

| | |
|---|---|
| **Prototype** | $AlC_2H_{36}N_2O_{20}S_2$ |
| **AFLOW prototype label** | AB2C36D2E20F2_cP252_205_a_c_6d_c_c3d_c-001 |
| ***Strukturbericht* designation** | $H4_{14}$ |
| **Mineral name** | $\beta$-alum |
| **ICSD** | 77599 |
| **Pearson symbol** | cP252 |
| **Space group number** | 205 |
| **Space group symbol** | $Pa\overline{3}$ |
| **AFLOW prototype command** | `aflow --proto=AB2C36D2E20F2_cP252_205_a_c_6d_c_c3d_c-001 --params=`$a, x_2, x_3, x_4, x_5, x_6, y_6, z_6, x_7, y_7, z_7, x_8, y_8, z_8, x_9, y_9, z_9, x_{10}, y_{10}, z_{10}, x_{11}, y_{11}, z_{11}, x_{12}, y_{12}, z_{12}, x_{13}, y_{13}, z_{13}, x_{14}, y_{14}, z_{14}$ |

**Other compounds with this structure**
$AlCs(SO_4)_2 \cdot 12H_2O$

- The alums have the general formula $AB(XO_4)_2 \cdot 12H_2O$, where A is a monovalent ion, B is a trivalent ion, and X is a chalcogen. In most cases atom B is aluminum and atom X is sulfur, leading to the name alum.
- All alums have their room-temperature form in space group $Pa\bar{3}$ #205, but the bonding between the A and B ions and the $XO_4$ complex can be quite different.
- (Lipson, 1935ab) described three general forms of alum based on the sizes of the monovalent ions. Each of these forms was given a *Strukturbericht* designation by (Gottfried, 1937):
  - $\alpha$-alum, with intermediate sized ions, prototype $KAl(SO_4)_2 \cdot 12H_2O$, $H4_{13}$,
  - $\beta$-alum, with large ions, prototype $(NH_3CH_3)Al(SO_4)_2 \cdot 12H_2O$, $H4_{14}$ (this structure), and
  - $\gamma$-alum, with small ions, prototype $NaAl(SO_4)_2 \cdot 12H_2O$, $H4_{15}$.
- This classification scheme is not compete, *e.g.*, (Ledsham, 1968) points out that $NaCr(SO_4)_2 \cdot 12H_2O$ does not fit into any of these categories, and that the actual structure depends on the combination of monovalent and trivalent ions.
- As noted above, the $Pa\bar{3}$ structures of alum are the room temperature form. As the temperature decreases the alum structure may transform. For example, in the temperature range 150-170K the $\beta$-alum $(NH_3CH_3)Al(SO_4)_2 \cdot 12H_2O$ transforms into an orthorhombic structure with fully ordered $NH_3CH_3$ ions.
- This structure was originally determined by (Lipsom, 1935c), could only determine that the $NH_3CH_3$ ion occupied the (4b) Wyckoff position. (Abdeen, 1981) showed that the ion was statistically distributed at two possible sites. The C-N bond distance is 1.4Å, slightly smaller than the 1.51Å distance observed in the low temperature structure. At any site, one of the two nitrogen positions is occupied, along with the carbon position 1.4Å away. Six hydrogen positions from the (H-I) and (H-II) sites are then occupied.

**Simple Cubic primitive vectors**

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




**Basis vectors**

| | | Lattice coordinates | | Cartesian coordinates | Wyckoff position | Atom type |
|---|---|---|---|---|---|---|
| $\mathbf{B_1}$ | = | $0$ | = | $0$ | (4a) | Al I |
| $\mathbf{B_2}$ | = | $\frac{1}{2}\,\mathbf{a}_1 + \frac{1}{2}\,\mathbf{a}_3$ | = | $\frac{1}{2}a\,\hat{\mathbf{x}} + \frac{1}{2}a\,\hat{\mathbf{z}}$ | (4a) | Al I |
| $\mathbf{B_3}$ | = | $\frac{1}{2}\,\mathbf{a}_2 + \frac{1}{2}\,\mathbf{a}_3$ | = | $\frac{1}{2}a\,\hat{\mathbf{y}} + \frac{1}{2}a\,\hat{\mathbf{z}}$ | (4a) | Al I |
| $\mathbf{B_4}$ | = | $\frac{1}{2}\,\mathbf{a}_1 + \frac{1}{2}\,\mathbf{a}_2$ | = | $\frac{1}{2}a\,\hat{\mathbf{x}} + \frac{1}{2}a\,\hat{\mathbf{y}}$ | (4a) | Al I |
| $\mathbf{B_5}$ | = | $x_2\,\mathbf{a}_1 + x_2\,\mathbf{a}_2 + x_2\,\mathbf{a}_3$ | = | $ax_2\,\hat{\mathbf{x}} + ax_2\,\hat{\mathbf{y}} + ax_2\,\hat{\mathbf{z}}$ | (8c) | C I |
| $\mathbf{B_6}$ | = | $-\left(x_2 - \frac{1}{2}\right)\,\mathbf{a}_1 - x_2\,\mathbf{a}_2 + \left(x_2 + \frac{1}{2}\right)\,\mathbf{a}_3$ | = | $-a\left(x_2 - \frac{1}{2}\right)\,\hat{\mathbf{x}} - ax_2\,\hat{\mathbf{y}} + a\left(x_2 + \frac{1}{2}\right)\,\hat{\mathbf{z}}$ | (8c) | C I |

| | | | | | | |
|---|---|---|---|---|---|---|
| $\mathbf{B_7}$ | = | $-x_2\,\mathbf{a}_1+\left(x_2+\frac{1}{2}\right)\,\mathbf{a}_2-\left(x_2-\frac{1}{2}\right)\,\mathbf{a}_3$ | = | $-ax_2\,\hat{\mathbf{x}}+a\left(x_2+\frac{1}{2}\right)\,\hat{\mathbf{y}}-a\left(x_2-\frac{1}{2}\right)\,\hat{\mathbf{z}}$ | (8c) | C I |
| $\mathbf{B_8}$ | = | $\left(x_2+\frac{1}{2}\right)\,\mathbf{a}_1-\left(x_2-\frac{1}{2}\right)\,\mathbf{a}_2-x_2\,\mathbf{a}_3$ | = | $a\left(x_2+\frac{1}{2}\right)\,\hat{\mathbf{x}}-a\left(x_2-\frac{1}{2}\right)\,\hat{\mathbf{y}}-ax_2\,\hat{\mathbf{z}}$ | (8c) | C I |
| $\mathbf{B_9}$ | = | $-x_2\,\mathbf{a}_1-x_2\,\mathbf{a}_2-x_2\,\mathbf{a}_3$ | = | $-ax_2\,\hat{\mathbf{x}}-ax_2\,\hat{\mathbf{y}}-ax_2\,\hat{\mathbf{z}}$ | (8c) | C I |
| $\mathbf{B_{10}}$ | = | $\left(x_2+\frac{1}{2}\right)\,\mathbf{a}_1+x_2\,\mathbf{a}_2-\left(x_2-\frac{1}{2}\right)\,\mathbf{a}_3$ | = | $a\left(x_2+\frac{1}{2}\right)\,\hat{\mathbf{x}}+ax_2\,\hat{\mathbf{y}}-a\left(x_2-\frac{1}{2}\right)\,\hat{\mathbf{z}}$ | (8c) | C I |
| $\mathbf{B_{11}}$ | = | $x_2\,\mathbf{a}_1-\left(x_2-\frac{1}{2}\right)\,\mathbf{a}_2+\left(x_2+\frac{1}{2}\right)\,\mathbf{a}_3$ | = | $ax_2\,\hat{\mathbf{x}}-a\left(x_2-\frac{1}{2}\right)\,\hat{\mathbf{y}}+a\left(x_2+\frac{1}{2}\right)\,\hat{\mathbf{z}}$ | (8c) | C I |
| $\mathbf{B_{12}}$ | = | $-\left(x_2-\frac{1}{2}\right)\,\mathbf{a}_1+\left(x_2+\frac{1}{2}\right)\,\mathbf{a}_2+x_2\,\mathbf{a}_3$ | = | $-a\left(x_2-\frac{1}{2}\right)\,\hat{\mathbf{x}}+a\left(x_2+\frac{1}{2}\right)\,\hat{\mathbf{y}}+ax_2\,\hat{\mathbf{z}}$ | (8c) | C I |
| $\mathbf{B_{13}}$ | = | $x_3\,\mathbf{a}_1+x_3\,\mathbf{a}_2+x_3\,\mathbf{a}_3$ | = | $ax_3\,\hat{\mathbf{x}}+ax_3\,\hat{\mathbf{y}}+ax_3\,\hat{\mathbf{z}}$ | (8c) | N I |
| $\mathbf{B_{14}}$ | = | $-\left(x_3-\frac{1}{2}\right)\,\mathbf{a}_1-x_3\,\mathbf{a}_2+\left(x_3+\frac{1}{2}\right)\,\mathbf{a}_3$ | = | $-a\left(x_3-\frac{1}{2}\right)\,\hat{\mathbf{x}}-ax_3\,\hat{\mathbf{y}}+a\left(x_3+\frac{1}{2}\right)\,\hat{\mathbf{z}}$ | (8c) | N I |
| $\mathbf{B_{15}}$ | = | $-x_3\,\mathbf{a}_1+\left(x_3+\frac{1}{2}\right)\,\mathbf{a}_2-\left(x_3-\frac{1}{2}\right)\,\mathbf{a}_3$ | = | $-ax_3\,\hat{\mathbf{x}}+a\left(x_3+\frac{1}{2}\right)\,\hat{\mathbf{y}}-a\left(x_3-\frac{1}{2}\right)\,\hat{\mathbf{z}}$ | (8c) | N I |
| $\mathbf{B_{16}}$ | = | $\left(x_3+\frac{1}{2}\right)\,\mathbf{a}_1-\left(x_3-\frac{1}{2}\right)\,\mathbf{a}_2-x_3\,\mathbf{a}_3$ | = | $a\left(x_3+\frac{1}{2}\right)\,\hat{\mathbf{x}}-a\left(x_3-\frac{1}{2}\right)\,\hat{\mathbf{y}}-ax_3\,\hat{\mathbf{z}}$ | (8c) | N I |
| $\mathbf{B_{17}}$ | = | $-x_3\,\mathbf{a}_1-x_3\,\mathbf{a}_2-x_3\,\mathbf{a}_3$ | = | $-ax_3\,\hat{\mathbf{x}}-ax_3\,\hat{\mathbf{y}}-ax_3\,\hat{\mathbf{z}}$ | (8c) | N I |
| $\mathbf{B_{18}}$ | = | $\left(x_3+\frac{1}{2}\right)\,\mathbf{a}_1+x_3\,\mathbf{a}_2-\left(x_3-\frac{1}{2}\right)\,\mathbf{a}_3$ | = | $a\left(x_3+\frac{1}{2}\right)\,\hat{\mathbf{x}}+ax_3\,\hat{\mathbf{y}}-a\left(x_3-\frac{1}{2}\right)\,\hat{\mathbf{z}}$ | (8c) | N I |
| $\mathbf{B_{19}}$ | = | $x_3\,\mathbf{a}_1-\left(x_3-\frac{1}{2}\right)\,\mathbf{a}_2+\left(x_3+\frac{1}{2}\right)\,\mathbf{a}_3$ | = | $ax_3\,\hat{\mathbf{x}}-a\left(x_3-\frac{1}{2}\right)\,\hat{\mathbf{y}}+a\left(x_3+\frac{1}{2}\right)\,\hat{\mathbf{z}}$ | (8c) | N I |
| $\mathbf{B_{20}}$ | = | $-\left(x_3-\frac{1}{2}\right)\,\mathbf{a}_1+\left(x_3+\frac{1}{2}\right)\,\mathbf{a}_2+x_3\,\mathbf{a}_3$ | = | $-a\left(x_3-\frac{1}{2}\right)\,\hat{\mathbf{x}}+a\left(x_3+\frac{1}{2}\right)\,\hat{\mathbf{y}}+ax_3\,\hat{\mathbf{z}}$ | (8c) | N I |
| $\mathbf{B_{21}}$ | = | $x_4\,\mathbf{a}_1+x_4\,\mathbf{a}_2+x_4\,\mathbf{a}_3$ | = | $ax_4\,\hat{\mathbf{x}}+ax_4\,\hat{\mathbf{y}}+ax_4\,\hat{\mathbf{z}}$ | (8c) | O I |
| $\mathbf{B_{22}}$ | = | $-\left(x_4-\frac{1}{2}\right)\,\mathbf{a}_1-x_4\,\mathbf{a}_2+\left(x_4+\frac{1}{2}\right)\,\mathbf{a}_3$ | = | $-a\left(x_4-\frac{1}{2}\right)\,\hat{\mathbf{x}}-ax_4\,\hat{\mathbf{y}}+a\left(x_4+\frac{1}{2}\right)\,\hat{\mathbf{z}}$ | (8c) | O I |
| $\mathbf{B_{23}}$ | = | $-x_4\,\mathbf{a}_1+\left(x_4+\frac{1}{2}\right)\,\mathbf{a}_2-\left(x_4-\frac{1}{2}\right)\,\mathbf{a}_3$ | = | $-ax_4\,\hat{\mathbf{x}}+a\left(x_4+\frac{1}{2}\right)\,\hat{\mathbf{y}}-a\left(x_4-\frac{1}{2}\right)\,\hat{\mathbf{z}}$ | (8c) | O I |
| $\mathbf{B_{24}}$ | = | $\left(x_4+\frac{1}{2}\right)\,\mathbf{a}_1-\left(x_4-\frac{1}{2}\right)\,\mathbf{a}_2-x_4\,\mathbf{a}_3$ | = | $a\left(x_4+\frac{1}{2}\right)\,\hat{\mathbf{x}}-a\left(x_4-\frac{1}{2}\right)\,\hat{\mathbf{y}}-ax_4\,\hat{\mathbf{z}}$ | (8c) | O I |
| $\mathbf{B_{25}}$ | = | $-x_4\,\mathbf{a}_1-x_4\,\mathbf{a}_2-x_4\,\mathbf{a}_3$ | = | $-ax_4\,\hat{\mathbf{x}}-ax_4\,\hat{\mathbf{y}}-ax_4\,\hat{\mathbf{z}}$ | (8c) | O I |
| $\mathbf{B_{26}}$ | = | $\left(x_4+\frac{1}{2}\right)\,\mathbf{a}_1+x_4\,\mathbf{a}_2-\left(x_4-\frac{1}{2}\right)\,\mathbf{a}_3$ | = | $a\left(x_4+\frac{1}{2}\right)\,\hat{\mathbf{x}}+ax_4\,\hat{\mathbf{y}}-a\left(x_4-\frac{1}{2}\right)\,\hat{\mathbf{z}}$ | (8c) | O I |
| $\mathbf{B_{27}}$ | = | $x_4\,\mathbf{a}_1-\left(x_4-\frac{1}{2}\right)\,\mathbf{a}_2+\left(x_4+\frac{1}{2}\right)\,\mathbf{a}_3$ | = | $ax_4\,\hat{\mathbf{x}}-a\left(x_4-\frac{1}{2}\right)\,\hat{\mathbf{y}}+a\left(x_4+\frac{1}{2}\right)\,\hat{\mathbf{z}}$ | (8c) | O I |
| $\mathbf{B_{28}}$ | = | $-\left(x_4-\frac{1}{2}\right)\,\mathbf{a}_1+\left(x_4+\frac{1}{2}\right)\,\mathbf{a}_2+x_4\,\mathbf{a}_3$ | = | $-a\left(x_4-\frac{1}{2}\right)\,\hat{\mathbf{x}}+a\left(x_4+\frac{1}{2}\right)\,\hat{\mathbf{y}}+ax_4\,\hat{\mathbf{z}}$ | (8c) | O I |
| $\mathbf{B_{29}}$ | = | $x_5\,\mathbf{a}_1+x_5\,\mathbf{a}_2+x_5\,\mathbf{a}_3$ | = | $ax_5\,\hat{\mathbf{x}}+ax_5\,\hat{\mathbf{y}}+ax_5\,\hat{\mathbf{z}}$ | (8c) | S I |
| $\mathbf{B_{30}}$ | = | $-\left(x_5-\frac{1}{2}\right)\,\mathbf{a}_1-x_5\,\mathbf{a}_2+\left(x_5+\frac{1}{2}\right)\,\mathbf{a}_3$ | = | $-a\left(x_5-\frac{1}{2}\right)\,\hat{\mathbf{x}}-ax_5\,\hat{\mathbf{y}}+a\left(x_5+\frac{1}{2}\right)\,\hat{\mathbf{z}}$ | (8c) | S I |
| $\mathbf{B_{31}}$ | = | $-x_5\,\mathbf{a}_1+\left(x_5+\frac{1}{2}\right)\,\mathbf{a}_2-\left(x_5-\frac{1}{2}\right)\,\mathbf{a}_3$ | = | $-ax_5\,\hat{\mathbf{x}}+a\left(x_5+\frac{1}{2}\right)\,\hat{\mathbf{y}}-a\left(x_5-\frac{1}{2}\right)\,\hat{\mathbf{z}}$ | (8c) | S I |
| $\mathbf{B_{32}}$ | = | $\left(x_5+\frac{1}{2}\right)\,\mathbf{a}_1-\left(x_5-\frac{1}{2}\right)\,\mathbf{a}_2-x_5\,\mathbf{a}_3$ | = | $a\left(x_5+\frac{1}{2}\right)\,\hat{\mathbf{x}}-a\left(x_5-\frac{1}{2}\right)\,\hat{\mathbf{y}}-ax_5\,\hat{\mathbf{z}}$ | (8c) | S I |
| $\mathbf{B_{33}}$ | = | $-x_5\,\mathbf{a}_1-x_5\,\mathbf{a}_2-x_5\,\mathbf{a}_3$ | = | $-ax_5\,\hat{\mathbf{x}}-ax_5\,\hat{\mathbf{y}}-ax_5\,\hat{\mathbf{z}}$ | (8c) | S I |
| $\mathbf{B_{34}}$ | = | $\left(x_5+\frac{1}{2}\right)\,\mathbf{a}_1+x_5\,\mathbf{a}_2-\left(x_5-\frac{1}{2}\right)\,\mathbf{a}_3$ | = | $a\left(x_5+\frac{1}{2}\right)\,\hat{\mathbf{x}}+ax_5\,\hat{\mathbf{y}}-a\left(x_5-\frac{1}{2}\right)\,\hat{\mathbf{z}}$ | (8c) | S I |
| $\mathbf{B_{35}}$ | = | $x_5\,\mathbf{a}_1-\left(x_5-\frac{1}{2}\right)\,\mathbf{a}_2+\left(x_5+\frac{1}{2}\right)\,\mathbf{a}_3$ | = | $ax_5\,\hat{\mathbf{x}}-a\left(x_5-\frac{1}{2}\right)\,\hat{\mathbf{y}}+a\left(x_5+\frac{1}{2}\right)\,\hat{\mathbf{z}}$ | (8c) | S I |
| $\mathbf{B_{36}}$ | = | $-\left(x_5-\frac{1}{2}\right)\,\mathbf{a}_1+\left(x_5+\frac{1}{2}\right)\,\mathbf{a}_2+x_5\,\mathbf{a}_3$ | = | $-a\left(x_5-\frac{1}{2}\right)\,\hat{\mathbf{x}}+a\left(x_5+\frac{1}{2}\right)\,\hat{\mathbf{y}}+ax_5\,\hat{\mathbf{z}}$ | (8c) | S I |
| $\mathbf{B_{37}}$ | = | $x_6\,\mathbf{a}_1+y_6\,\mathbf{a}_2+z_6\,\mathbf{a}_3$ | = | $ax_6\,\hat{\mathbf{x}}+ay_6\,\hat{\mathbf{y}}+az_6\,\hat{\mathbf{z}}$ | (24d) | H I |
| $\mathbf{B_{38}}$ | = | $-\left(x_6-\frac{1}{2}\right)\,\mathbf{a}_1-y_6\,\mathbf{a}_2+\left(z_6+\frac{1}{2}\right)\,\mathbf{a}_3$ | = | $-a\left(x_6-\frac{1}{2}\right)\,\hat{\mathbf{x}}-ay_6\,\hat{\mathbf{y}}+a\left(z_6+\frac{1}{2}\right)\,\hat{\mathbf{z}}$ | (24d) | H I |

$$
\begin{array}{lcccccc}
\mathbf{B_{39}} & = & -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}}+a\left(y_6+\frac{1}{2}\right)\,\hat{\mathbf{y}}-a\left(z_6-\frac{1}{2}\right)\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{40}} & = & \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}}-a\left(y_6-\frac{1}{2}\right)\,\hat{\mathbf{y}}-az_6\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{41}} & = & z_6\,\mathbf{a}_1+x_6\,\mathbf{a}_2+y_6\,\mathbf{a}_3 & = & az_6\,\hat{\mathbf{x}}+ax_6\,\hat{\mathbf{y}}+ay_6\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{42}} & = & \left(z_6+\frac{1}{2}\right)\,\mathbf{a}_1-\left(x_6-\frac{1}{2}\right)\,\mathbf{a}_2-y_6\,\mathbf{a}_3 & = & a\left(z_6+\frac{1}{2}\right)\,\hat{\mathbf{x}}-a\left(x_6-\frac{1}{2}\right)\,\hat{\mathbf{y}}-ay_6\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{43}} & = & -\left(z_6-\frac{1}{2}\right)\,\mathbf{a}_1-x_6\,\mathbf{a}_2+\left(y_6+\frac{1}{2}\right)\,\mathbf{a}_3 & = & -a\left(z_6-\frac{1}{2}\right)\,\hat{\mathbf{x}}-ax_6\,\hat{\mathbf{y}}+a\left(y_6+\frac{1}{2}\right)\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{44}} & = & -z_6\,\mathbf{a}_1+\left(x_6+\frac{1}{2}\right)\,\mathbf{a}_2-\left(y_6-\frac{1}{2}\right)\,\mathbf{a}_3 & = & -az_6\,\hat{\mathbf{x}}+a\left(x_6+\frac{1}{2}\right)\,\hat{\mathbf{y}}-a\left(y_6-\frac{1}{2}\right)\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{45}} & = & y_6\,\mathbf{a}_1+z_6\,\mathbf{a}_2+x_6\,\mathbf{a}_3 & = & ay_6\,\hat{\mathbf{x}}+az_6\,\hat{\mathbf{y}}+ax_6\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{46}} & = & -y_6\,\mathbf{a}_1+\left(z_6+\frac{1}{2}\right)\,\mathbf{a}_2-\left(x_6-\frac{1}{2}\right)\,\mathbf{a}_3 & = & -ay_6\,\hat{\mathbf{x}}+a\left(z_6+\frac{1}{2}\right)\,\hat{\mathbf{y}}-a\left(x_6-\frac{1}{2}\right)\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{47}} & = & \left(y_6+\frac{1}{2}\right)\,\mathbf{a}_1-\left(z_6-\frac{1}{2}\right)\,\mathbf{a}_2-x_6\,\mathbf{a}_3 & = & a\left(y_6+\frac{1}{2}\right)\,\hat{\mathbf{x}}-a\left(z_6-\frac{1}{2}\right)\,\hat{\mathbf{y}}-ax_6\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{48}} & = & -\left(y_6-\frac{1}{2}\right)\,\mathbf{a}_1-z_6\,\mathbf{a}_2+\left(x_6+\frac{1}{2}\right)\,\mathbf{a}_3 & = & -a\left(y_6-\frac{1}{2}\right)\,\hat{\mathbf{x}}-az_6\,\hat{\mathbf{y}}+a\left(x_6+\frac{1}{2}\right)\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{49}} & = & -x_6\,\mathbf{a}_1-y_6\,\mathbf{a}_2-z_6\,\mathbf{a}_3 & = & -ax_6\,\hat{\mathbf{x}}-ay_6\,\hat{\mathbf{y}}-az_6\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{50}} & = & \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}}+ay_6\,\hat{\mathbf{y}}-a\left(z_6-\frac{1}{2}\right)\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{51}} & = & 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}}-a\left(y_6-\frac{1}{2}\right)\,\hat{\mathbf{y}}+a\left(z_6+\frac{1}{2}\right)\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{52}} & = & -\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}}+a\left(y_6+\frac{1}{2}\right)\,\hat{\mathbf{y}}+az_6\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{53}} & = & -z_6\,\mathbf{a}_1-x_6\,\mathbf{a}_2-y_6\,\mathbf{a}_3 & = & -az_6\,\hat{\mathbf{x}}-ax_6\,\hat{\mathbf{y}}-ay_6\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{54}} & = & -\left(z_6-\frac{1}{2}\right)\,\mathbf{a}_1+\left(x_6+\frac{1}{2}\right)\,\mathbf{a}_2+y_6\,\mathbf{a}_3 & = & -a\left(z_6-\frac{1}{2}\right)\,\hat{\mathbf{x}}+a\left(x_6+\frac{1}{2}\right)\,\hat{\mathbf{y}}+ay_6\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{55}} & = & \left(z_6+\frac{1}{2}\right)\,\mathbf{a}_1+x_6\,\mathbf{a}_2-\left(y_6-\frac{1}{2}\right)\,\mathbf{a}_3 & = & a\left(z_6+\frac{1}{2}\right)\,\hat{\mathbf{x}}+ax_6\,\hat{\mathbf{y}}-a\left(y_6-\frac{1}{2}\right)\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{56}} & = & z_6\,\mathbf{a}_1-\left(x_6-\frac{1}{2}\right)\,\mathbf{a}_2+\left(y_6+\frac{1}{2}\right)\,\mathbf{a}_3 & = & az_6\,\hat{\mathbf{x}}-a\left(x_6-\frac{1}{2}\right)\,\hat{\mathbf{y}}+a\left(y_6+\frac{1}{2}\right)\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{57}} & = & -y_6\,\mathbf{a}_1-z_6\,\mathbf{a}_2-x_6\,\mathbf{a}_3 & = & -ay_6\,\hat{\mathbf{x}}-az_6\,\hat{\mathbf{y}}-ax_6\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{58}} & = & y_6\,\mathbf{a}_1-\left(z_6-\frac{1}{2}\right)\,\mathbf{a}_2+\left(x_6+\frac{1}{2}\right)\,\mathbf{a}_3 & = & ay_6\,\hat{\mathbf{x}}-a\left(z_6-\frac{1}{2}\right)\,\hat{\mathbf{y}}+a\left(x_6+\frac{1}{2}\right)\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{59}} & = & -\left(y_6-\frac{1}{2}\right)\,\mathbf{a}_1+\left(z_6+\frac{1}{2}\right)\,\mathbf{a}_2+x_6\,\mathbf{a}_3 & = & -a\left(y_6-\frac{1}{2}\right)\,\hat{\mathbf{x}}+a\left(z_6+\frac{1}{2}\right)\,\hat{\mathbf{y}}+ax_6\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{60}} & = & \left(y_6+\frac{1}{2}\right)\,\mathbf{a}_1+z_6\,\mathbf{a}_2-\left(x_6-\frac{1}{2}\right)\,\mathbf{a}_3 & = & a\left(y_6+\frac{1}{2}\right)\,\hat{\mathbf{x}}+az_6\,\hat{\mathbf{y}}-a\left(x_6-\frac{1}{2}\right)\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ I}\\
\mathbf{B_{61}} & = & x_7\,\mathbf{a}_1+y_7\,\mathbf{a}_2+z_7\,\mathbf{a}_3 & = & ax_7\,\hat{\mathbf{x}}+ay_7\,\hat{\mathbf{y}}+az_7\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ II}\\
\mathbf{B_{62}} & = & -\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}}-ay_7\,\hat{\mathbf{y}}+a\left(z_7+\frac{1}{2}\right)\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ II}\\
\mathbf{B_{63}} & = & -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}}+a\left(y_7+\frac{1}{2}\right)\,\hat{\mathbf{y}}-a\left(z_7-\frac{1}{2}\right)\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ II}\\
\mathbf{B_{64}} & = & \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}}-a\left(y_7-\frac{1}{2}\right)\,\hat{\mathbf{y}}-az_7\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ II}\\
\mathbf{B_{65}} & = & z_7\,\mathbf{a}_1+x_7\,\mathbf{a}_2+y_7\,\mathbf{a}_3 & = & az_7\,\hat{\mathbf{x}}+ax_7\,\hat{\mathbf{y}}+ay_7\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ II}\\
\mathbf{B_{66}} & = & \left(z_7+\frac{1}{2}\right)\,\mathbf{a}_1-\left(x_7-\frac{1}{2}\right)\,\mathbf{a}_2-y_7\,\mathbf{a}_3 & = & a\left(z_7+\frac{1}{2}\right)\,\hat{\mathbf{x}}-a\left(x_7-\frac{1}{2}\right)\,\hat{\mathbf{y}}-ay_7\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ II}\\
\mathbf{B_{67}} & = & -\left(z_7-\frac{1}{2}\right)\,\mathbf{a}_1-x_7\,\mathbf{a}_2+\left(y_7+\frac{1}{2}\right)\,\mathbf{a}_3 & = & -a\left(z_7-\frac{1}{2}\right)\,\hat{\mathbf{x}}-ax_7\,\hat{\mathbf{y}}+a\left(y_7+\frac{1}{2}\right)\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ II}\\
\mathbf{B_{68}} & = & -z_7\,\mathbf{a}_1+\left(x_7+\frac{1}{2}\right)\,\mathbf{a}_2-\left(y_7-\frac{1}{2}\right)\,\mathbf{a}_3 & = & -az_7\,\hat{\mathbf{x}}+a\left(x_7+\frac{1}{2}\right)\,\hat{\mathbf{y}}-a\left(y_7-\frac{1}{2}\right)\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ II}\\
\mathbf{B_{69}} & = & y_7\,\mathbf{a}_1+z_7\,\mathbf{a}_2+x_7\,\mathbf{a}_3 & = & ay_7\,\hat{\mathbf{x}}+az_7\,\hat{\mathbf{y}}+ax_7\,\hat{\mathbf{z}} & (24\mathrm{d}) & \mathrm{H\ II}
\end{array}
$$

$$\mathbf{B_{70}} = -y_7\,\mathbf{a}_1 + \left(z_7+\tfrac{1}{2}\right)\,\mathbf{a}_2 - \left(x_7-\tfrac{1}{2}\right)\,\mathbf{a}_3 = -ay_7\,\hat{\mathbf{x}} + a\left(z_7+\tfrac{1}{2}\right)\,\hat{\mathbf{y}} - a\left(x_7-\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{H II}$$

$$\mathbf{B_{71}} = \left(y_7+\tfrac{1}{2}\right)\,\mathbf{a}_1 - \left(z_7-\tfrac{1}{2}\right)\,\mathbf{a}_2 - x_7\,\mathbf{a}_3 = a\left(y_7+\tfrac{1}{2}\right)\,\hat{\mathbf{x}} - a\left(z_7-\tfrac{1}{2}\right)\,\hat{\mathbf{y}} - ax_7\,\hat{\mathbf{z}} \quad (24d) \quad \text{H II}$$

$$\mathbf{B_{72}} = -\left(y_7-\tfrac{1}{2}\right)\,\mathbf{a}_1 - z_7\,\mathbf{a}_2 + \left(x_7+\tfrac{1}{2}\right)\,\mathbf{a}_3 = -a\left(y_7-\tfrac{1}{2}\right)\,\hat{\mathbf{x}} - az_7\,\hat{\mathbf{y}} + a\left(x_7+\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{H II}$$

$$\mathbf{B_{73}} = -x_7\,\mathbf{a}_1 - y_7\,\mathbf{a}_2 - z_7\,\mathbf{a}_3 = -ax_7\,\hat{\mathbf{x}} - ay_7\,\hat{\mathbf{y}} - az_7\,\hat{\mathbf{z}} \quad (24d) \quad \text{H II}$$

$$\mathbf{B_{74}} = \left(x_7+\tfrac{1}{2}\right)\,\mathbf{a}_1 + y_7\,\mathbf{a}_2 - \left(z_7-\tfrac{1}{2}\right)\,\mathbf{a}_3 = a\left(x_7+\tfrac{1}{2}\right)\,\hat{\mathbf{x}} + ay_7\,\hat{\mathbf{y}} - a\left(z_7-\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{H II}$$

$$\mathbf{B_{75}} = x_7\,\mathbf{a}_1 - \left(y_7-\tfrac{1}{2}\right)\,\mathbf{a}_2 + \left(z_7+\tfrac{1}{2}\right)\,\mathbf{a}_3 = ax_7\,\hat{\mathbf{x}} - a\left(y_7-\tfrac{1}{2}\right)\,\hat{\mathbf{y}} + a\left(z_7+\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{H II}$$

$$\mathbf{B_{76}} = -\left(x_7-\tfrac{1}{2}\right)\,\mathbf{a}_1 + \left(y_7+\tfrac{1}{2}\right)\,\mathbf{a}_2 + z_7\,\mathbf{a}_3 = -a\left(x_7-\tfrac{1}{2}\right)\,\hat{\mathbf{x}} + a\left(y_7+\tfrac{1}{2}\right)\,\hat{\mathbf{y}} + az_7\,\hat{\mathbf{z}} \quad (24d) \quad \text{H II}$$

$$\mathbf{B_{77}} = -z_7\,\mathbf{a}_1 - x_7\,\mathbf{a}_2 - y_7\,\mathbf{a}_3 = -az_7\,\hat{\mathbf{x}} - ax_7\,\hat{\mathbf{y}} - ay_7\,\hat{\mathbf{z}} \quad (24d) \quad \text{H II}$$

$$\mathbf{B_{78}} = -\left(z_7-\tfrac{1}{2}\right)\,\mathbf{a}_1 + \left(x_7+\tfrac{1}{2}\right)\,\mathbf{a}_2 + y_7\,\mathbf{a}_3 = -a\left(z_7-\tfrac{1}{2}\right)\,\hat{\mathbf{x}} + a\left(x_7+\tfrac{1}{2}\right)\,\hat{\mathbf{y}} + ay_7\,\hat{\mathbf{z}} \quad (24d) \quad \text{H II}$$

$$\mathbf{B_{79}} = \left(z_7+\tfrac{1}{2}\right)\,\mathbf{a}_1 + x_7\,\mathbf{a}_2 - \left(y_7-\tfrac{1}{2}\right)\,\mathbf{a}_3 = a\left(z_7+\tfrac{1}{2}\right)\,\hat{\mathbf{x}} + ax_7\,\hat{\mathbf{y}} - a\left(y_7-\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{H II}$$

$$\mathbf{B_{80}} = z_7\,\mathbf{a}_1 - \left(x_7-\tfrac{1}{2}\right)\,\mathbf{a}_2 + \left(y_7+\tfrac{1}{2}\right)\,\mathbf{a}_3 = az_7\,\hat{\mathbf{x}} - a\left(x_7-\tfrac{1}{2}\right)\,\hat{\mathbf{y}} + a\left(y_7+\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{H II}$$

$$\mathbf{B_{81}} = -y_7\,\mathbf{a}_1 - z_7\,\mathbf{a}_2 - x_7\,\mathbf{a}_3 = -ay_7\,\hat{\mathbf{x}} - az_7\,\hat{\mathbf{y}} - ax_7\,\hat{\mathbf{z}} \quad (24d) \quad \text{H II}$$

$$\mathbf{B_{82}} = y_7\,\mathbf{a}_1 - \left(z_7-\tfrac{1}{2}\right)\,\mathbf{a}_2 + \left(x_7+\tfrac{1}{2}\right)\,\mathbf{a}_3 = ay_7\,\hat{\mathbf{x}} - a\left(z_7-\tfrac{1}{2}\right)\,\hat{\mathbf{y}} + a\left(x_7+\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{H II}$$

$$\mathbf{B_{83}} = -\left(y_7-\tfrac{1}{2}\right)\,\mathbf{a}_1 + \left(z_7+\tfrac{1}{2}\right)\,\mathbf{a}_2 + x_7\,\mathbf{a}_3 = -a\left(y_7-\tfrac{1}{2}\right)\,\hat{\mathbf{x}} + a\left(z_7+\tfrac{1}{2}\right)\,\hat{\mathbf{y}} + ax_7\,\hat{\mathbf{z}} \quad (24d) \quad \text{H II}$$

$$\mathbf{B_{84}} = \left(y_7+\tfrac{1}{2}\right)\,\mathbf{a}_1 + z_7\,\mathbf{a}_2 - \left(x_7-\tfrac{1}{2}\right)\,\mathbf{a}_3 = a\left(y_7+\tfrac{1}{2}\right)\,\hat{\mathbf{x}} + az_7\,\hat{\mathbf{y}} - a\left(x_7-\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{H II}$$

$$\mathbf{B_{85}} = x_8\,\mathbf{a}_1 + y_8\,\mathbf{a}_2 + z_8\,\mathbf{a}_3 = ax_8\,\hat{\mathbf{x}} + ay_8\,\hat{\mathbf{y}} + az_8\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{86}} = -\left(x_8-\tfrac{1}{2}\right)\,\mathbf{a}_1 - y_8\,\mathbf{a}_2 + \left(z_8+\tfrac{1}{2}\right)\,\mathbf{a}_3 = -a\left(x_8-\tfrac{1}{2}\right)\,\hat{\mathbf{x}} - ay_8\,\hat{\mathbf{y}} + a\left(z_8+\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{87}} = -x_8\,\mathbf{a}_1 + \left(y_8+\tfrac{1}{2}\right)\,\mathbf{a}_2 - \left(z_8-\tfrac{1}{2}\right)\,\mathbf{a}_3 = -ax_8\,\hat{\mathbf{x}} + a\left(y_8+\tfrac{1}{2}\right)\,\hat{\mathbf{y}} - a\left(z_8-\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{88}} = \left(x_8+\tfrac{1}{2}\right)\,\mathbf{a}_1 - \left(y_8-\tfrac{1}{2}\right)\,\mathbf{a}_2 - z_8\,\mathbf{a}_3 = a\left(x_8+\tfrac{1}{2}\right)\,\hat{\mathbf{x}} - a\left(y_8-\tfrac{1}{2}\right)\,\hat{\mathbf{y}} - az_8\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{89}} = z_8\,\mathbf{a}_1 + x_8\,\mathbf{a}_2 + y_8\,\mathbf{a}_3 = az_8\,\hat{\mathbf{x}} + ax_8\,\hat{\mathbf{y}} + ay_8\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{90}} = \left(z_8+\tfrac{1}{2}\right)\,\mathbf{a}_1 - \left(x_8-\tfrac{1}{2}\right)\,\mathbf{a}_2 - y_8\,\mathbf{a}_3 = a\left(z_8+\tfrac{1}{2}\right)\,\hat{\mathbf{x}} - a\left(x_8-\tfrac{1}{2}\right)\,\hat{\mathbf{y}} - ay_8\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{91}} = -\left(z_8-\tfrac{1}{2}\right)\,\mathbf{a}_1 - x_8\,\mathbf{a}_2 + \left(y_8+\tfrac{1}{2}\right)\,\mathbf{a}_3 = -a\left(z_8-\tfrac{1}{2}\right)\,\hat{\mathbf{x}} - ax_8\,\hat{\mathbf{y}} + a\left(y_8+\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{92}} = -z_8\,\mathbf{a}_1 + \left(x_8+\tfrac{1}{2}\right)\,\mathbf{a}_2 - \left(y_8-\tfrac{1}{2}\right)\,\mathbf{a}_3 = -az_8\,\hat{\mathbf{x}} + a\left(x_8+\tfrac{1}{2}\right)\,\hat{\mathbf{y}} - a\left(y_8-\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{93}} = y_8\,\mathbf{a}_1 + z_8\,\mathbf{a}_2 + x_8\,\mathbf{a}_3 = ay_8\,\hat{\mathbf{x}} + az_8\,\hat{\mathbf{y}} + ax_8\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{94}} = -y_8\,\mathbf{a}_1 + \left(z_8+\tfrac{1}{2}\right)\,\mathbf{a}_2 - \left(x_8-\tfrac{1}{2}\right)\,\mathbf{a}_3 = -ay_8\,\hat{\mathbf{x}} + a\left(z_8+\tfrac{1}{2}\right)\,\hat{\mathbf{y}} - a\left(x_8-\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{95}} = \left(y_8+\tfrac{1}{2}\right)\,\mathbf{a}_1 - \left(z_8-\tfrac{1}{2}\right)\,\mathbf{a}_2 - x_8\,\mathbf{a}_3 = a\left(y_8+\tfrac{1}{2}\right)\,\hat{\mathbf{x}} - a\left(z_8-\tfrac{1}{2}\right)\,\hat{\mathbf{y}} - ax_8\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{96}} = -\left(y_8-\tfrac{1}{2}\right)\,\mathbf{a}_1 - z_8\,\mathbf{a}_2 + \left(x_8+\tfrac{1}{2}\right)\,\mathbf{a}_3 = -a\left(y_8-\tfrac{1}{2}\right)\,\hat{\mathbf{x}} - az_8\,\hat{\mathbf{y}} + a\left(x_8+\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{97}} = -x_8\,\mathbf{a}_1 - y_8\,\mathbf{a}_2 - z_8\,\mathbf{a}_3 = -ax_8\,\hat{\mathbf{x}} - ay_8\,\hat{\mathbf{y}} - az_8\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{98}} = \left(x_8+\tfrac{1}{2}\right)\,\mathbf{a}_1 + y_8\,\mathbf{a}_2 - \left(z_8-\tfrac{1}{2}\right)\,\mathbf{a}_3 = a\left(x_8+\tfrac{1}{2}\right)\,\hat{\mathbf{x}} + ay_8\,\hat{\mathbf{y}} - a\left(z_8-\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{99}} = x_8\,\mathbf{a}_1 - \left(y_8-\tfrac{1}{2}\right)\,\mathbf{a}_2 + \left(z_8+\tfrac{1}{2}\right)\,\mathbf{a}_3 = ax_8\,\hat{\mathbf{x}} - a\left(y_8-\tfrac{1}{2}\right)\,\hat{\mathbf{y}} + a\left(z_8+\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{100}} = -\left(x_8-\tfrac{1}{2}\right)\,\mathbf{a}_1 + \left(y_8+\tfrac{1}{2}\right)\,\mathbf{a}_2 + z_8\,\mathbf{a}_3 = -a\left(x_8-\tfrac{1}{2}\right)\,\hat{\mathbf{x}} + a\left(y_8+\tfrac{1}{2}\right)\,\hat{\mathbf{y}} + az_8\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{101}} = -z_8\,\mathbf{a}_1 - x_8\,\mathbf{a}_2 - y_8\,\mathbf{a}_3 = -az_8\,\hat{\mathbf{x}} - ax_8\,\hat{\mathbf{y}} - ay_8\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{102}} = -\left(z_8-\tfrac{1}{2}\right)\mathbf{a}_1+\left(x_8+\tfrac{1}{2}\right)\mathbf{a}_2+y_8\,\mathbf{a}_3 = -a\left(z_8-\tfrac{1}{2}\right)\hat{\mathbf{x}}+a\left(x_8+\tfrac{1}{2}\right)\hat{\mathbf{y}}+ay_8\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{103}} = \left(z_8+\tfrac{1}{2}\right)\mathbf{a}_1+x_8\,\mathbf{a}_2-\left(y_8-\tfrac{1}{2}\right)\mathbf{a}_3 = a\left(z_8+\tfrac{1}{2}\right)\hat{\mathbf{x}}+ax_8\,\hat{\mathbf{y}}-a\left(y_8-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{104}} = z_8\,\mathbf{a}_1-\left(x_8-\tfrac{1}{2}\right)\mathbf{a}_2+\left(y_8+\tfrac{1}{2}\right)\mathbf{a}_3 = az_8\,\hat{\mathbf{x}}-a\left(x_8-\tfrac{1}{2}\right)\hat{\mathbf{y}}+a\left(y_8+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{105}} = -y_8\,\mathbf{a}_1-z_8\,\mathbf{a}_2-x_8\,\mathbf{a}_3 = -ay_8\,\hat{\mathbf{x}}-az_8\,\hat{\mathbf{y}}-ax_8\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{106}} = y_8\,\mathbf{a}_1-\left(z_8-\tfrac{1}{2}\right)\mathbf{a}_2+\left(x_8+\tfrac{1}{2}\right)\mathbf{a}_3 = ay_8\,\hat{\mathbf{x}}-a\left(z_8-\tfrac{1}{2}\right)\hat{\mathbf{y}}+a\left(x_8+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{107}} = -\left(y_8-\tfrac{1}{2}\right)\mathbf{a}_1+\left(z_8+\tfrac{1}{2}\right)\mathbf{a}_2+x_8\,\mathbf{a}_3 = -a\left(y_8-\tfrac{1}{2}\right)\hat{\mathbf{x}}+a\left(z_8+\tfrac{1}{2}\right)\hat{\mathbf{y}}+ax_8\,\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{108}} = \left(y_8+\tfrac{1}{2}\right)\mathbf{a}_1+z_8\,\mathbf{a}_2-\left(x_8-\tfrac{1}{2}\right)\mathbf{a}_3 = a\left(y_8+\tfrac{1}{2}\right)\hat{\mathbf{x}}+az_8\,\hat{\mathbf{y}}-a\left(x_8-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H III}$$

$$\mathbf{B_{109}} = x_9\,\mathbf{a}_1+y_9\,\mathbf{a}_2+z_9\,\mathbf{a}_3 = ax_9\,\hat{\mathbf{x}}+ay_9\,\hat{\mathbf{y}}+az_9\,\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{110}} = -\left(x_9-\tfrac{1}{2}\right)\mathbf{a}_1-y_9\,\mathbf{a}_2+\left(z_9+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(x_9-\tfrac{1}{2}\right)\hat{\mathbf{x}}-ay_9\,\hat{\mathbf{y}}+a\left(z_9+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{111}} = -x_9\,\mathbf{a}_1+\left(y_9+\tfrac{1}{2}\right)\mathbf{a}_2-\left(z_9-\tfrac{1}{2}\right)\mathbf{a}_3 = -ax_9\,\hat{\mathbf{x}}+a\left(y_9+\tfrac{1}{2}\right)\hat{\mathbf{y}}-a\left(z_9-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{112}} = \left(x_9+\tfrac{1}{2}\right)\mathbf{a}_1-\left(y_9-\tfrac{1}{2}\right)\mathbf{a}_2-z_9\,\mathbf{a}_3 = a\left(x_9+\tfrac{1}{2}\right)\hat{\mathbf{x}}-a\left(y_9-\tfrac{1}{2}\right)\hat{\mathbf{y}}-az_9\,\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{113}} = z_9\,\mathbf{a}_1+x_9\,\mathbf{a}_2+y_9\,\mathbf{a}_3 = az_9\,\hat{\mathbf{x}}+ax_9\,\hat{\mathbf{y}}+ay_9\,\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{114}} = \left(z_9+\tfrac{1}{2}\right)\mathbf{a}_1-\left(x_9-\tfrac{1}{2}\right)\mathbf{a}_2-y_9\,\mathbf{a}_3 = a\left(z_9+\tfrac{1}{2}\right)\hat{\mathbf{x}}-a\left(x_9-\tfrac{1}{2}\right)\hat{\mathbf{y}}-ay_9\,\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{115}} = -\left(z_9-\tfrac{1}{2}\right)\mathbf{a}_1-x_9\,\mathbf{a}_2+\left(y_9+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(z_9-\tfrac{1}{2}\right)\hat{\mathbf{x}}-ax_9\,\hat{\mathbf{y}}+a\left(y_9+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{116}} = -z_9\,\mathbf{a}_1+\left(x_9+\tfrac{1}{2}\right)\mathbf{a}_2-\left(y_9-\tfrac{1}{2}\right)\mathbf{a}_3 = -az_9\,\hat{\mathbf{x}}+a\left(x_9+\tfrac{1}{2}\right)\hat{\mathbf{y}}-a\left(y_9-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{117}} = y_9\,\mathbf{a}_1+z_9\,\mathbf{a}_2+x_9\,\mathbf{a}_3 = ay_9\,\hat{\mathbf{x}}+az_9\,\hat{\mathbf{y}}+ax_9\,\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{118}} = -y_9\,\mathbf{a}_1+\left(z_9+\tfrac{1}{2}\right)\mathbf{a}_2-\left(x_9-\tfrac{1}{2}\right)\mathbf{a}_3 = -ay_9\,\hat{\mathbf{x}}+a\left(z_9+\tfrac{1}{2}\right)\hat{\mathbf{y}}-a\left(x_9-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{119}} = \left(y_9+\tfrac{1}{2}\right)\mathbf{a}_1-\left(z_9-\tfrac{1}{2}\right)\mathbf{a}_2-x_9\,\mathbf{a}_3 = a\left(y_9+\tfrac{1}{2}\right)\hat{\mathbf{x}}-a\left(z_9-\tfrac{1}{2}\right)\hat{\mathbf{y}}-ax_9\,\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{120}} = -\left(y_9-\tfrac{1}{2}\right)\mathbf{a}_1-z_9\,\mathbf{a}_2+\left(x_9+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(y_9-\tfrac{1}{2}\right)\hat{\mathbf{x}}-az_9\,\hat{\mathbf{y}}+a\left(x_9+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{121}} = -x_9\,\mathbf{a}_1-y_9\,\mathbf{a}_2-z_9\,\mathbf{a}_3 = -ax_9\,\hat{\mathbf{x}}-ay_9\,\hat{\mathbf{y}}-az_9\,\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{122}} = \left(x_9+\tfrac{1}{2}\right)\mathbf{a}_1+y_9\,\mathbf{a}_2-\left(z_9-\tfrac{1}{2}\right)\mathbf{a}_3 = a\left(x_9+\tfrac{1}{2}\right)\hat{\mathbf{x}}+ay_9\,\hat{\mathbf{y}}-a\left(z_9-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{123}} = x_9\,\mathbf{a}_1-\left(y_9-\tfrac{1}{2}\right)\mathbf{a}_2+\left(z_9+\tfrac{1}{2}\right)\mathbf{a}_3 = ax_9\,\hat{\mathbf{x}}-a\left(y_9-\tfrac{1}{2}\right)\hat{\mathbf{y}}+a\left(z_9+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{124}} = -\left(x_9-\tfrac{1}{2}\right)\mathbf{a}_1+\left(y_9+\tfrac{1}{2}\right)\mathbf{a}_2+z_9\,\mathbf{a}_3 = -a\left(x_9-\tfrac{1}{2}\right)\hat{\mathbf{x}}+a\left(y_9+\tfrac{1}{2}\right)\hat{\mathbf{y}}+az_9\,\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{125}} = -z_9\,\mathbf{a}_1-x_9\,\mathbf{a}_2-y_9\,\mathbf{a}_3 = -az_9\,\hat{\mathbf{x}}-ax_9\,\hat{\mathbf{y}}-ay_9\,\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{126}} = -\left(z_9-\tfrac{1}{2}\right)\mathbf{a}_1+\left(x_9+\tfrac{1}{2}\right)\mathbf{a}_2+y_9\,\mathbf{a}_3 = -a\left(z_9-\tfrac{1}{2}\right)\hat{\mathbf{x}}+a\left(x_9+\tfrac{1}{2}\right)\hat{\mathbf{y}}+ay_9\,\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{127}} = \left(z_9+\tfrac{1}{2}\right)\mathbf{a}_1+x_9\,\mathbf{a}_2-\left(y_9-\tfrac{1}{2}\right)\mathbf{a}_3 = a\left(z_9+\tfrac{1}{2}\right)\hat{\mathbf{x}}+ax_9\,\hat{\mathbf{y}}-a\left(y_9-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{128}} = z_9\,\mathbf{a}_1-\left(x_9-\tfrac{1}{2}\right)\mathbf{a}_2+\left(y_9+\tfrac{1}{2}\right)\mathbf{a}_3 = az_9\,\hat{\mathbf{x}}-a\left(x_9-\tfrac{1}{2}\right)\hat{\mathbf{y}}+a\left(y_9+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{129}} = -y_9\,\mathbf{a}_1-z_9\,\mathbf{a}_2-x_9\,\mathbf{a}_3 = -ay_9\,\hat{\mathbf{x}}-az_9\,\hat{\mathbf{y}}-ax_9\,\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{130}} = y_9\,\mathbf{a}_1-\left(z_9-\tfrac{1}{2}\right)\mathbf{a}_2+\left(x_9+\tfrac{1}{2}\right)\mathbf{a}_3 = ay_9\,\hat{\mathbf{x}}-a\left(z_9-\tfrac{1}{2}\right)\hat{\mathbf{y}}+a\left(x_9+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{131}} = -\left(y_9-\tfrac{1}{2}\right)\mathbf{a}_1+\left(z_9+\tfrac{1}{2}\right)\mathbf{a}_2+x_9\,\mathbf{a}_3 = -a\left(y_9-\tfrac{1}{2}\right)\hat{\mathbf{x}}+a\left(z_9+\tfrac{1}{2}\right)\hat{\mathbf{y}}+ax_9\,\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{132}} = \left(y_9+\tfrac{1}{2}\right)\mathbf{a}_1+z_9\,\mathbf{a}_2-\left(x_9-\tfrac{1}{2}\right)\mathbf{a}_3 = a\left(y_9+\tfrac{1}{2}\right)\hat{\mathbf{x}}+az_9\,\hat{\mathbf{y}}-a\left(x_9-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H IV}$$

$$\mathbf{B_{133}} = x_{10}\,\mathbf{a}_1+y_{10}\,\mathbf{a}_2+z_{10}\,\mathbf{a}_3 = ax_{10}\,\hat{\mathbf{x}}+ay_{10}\,\hat{\mathbf{y}}+az_{10}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{134}} = -\left(x_{10}-\tfrac{1}{2}\right)\mathbf{a}_1 - y_{10}\,\mathbf{a}_2 + \left(z_{10}+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(x_{10}-\tfrac{1}{2}\right)\hat{\mathbf{x}} - ay_{10}\,\hat{\mathbf{y}} + a\left(z_{10}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{135}} = -x_{10}\,\mathbf{a}_1 + \left(y_{10}+\tfrac{1}{2}\right)\mathbf{a}_2 - \left(z_{10}-\tfrac{1}{2}\right)\mathbf{a}_3 = -ax_{10}\,\hat{\mathbf{x}} + a\left(y_{10}+\tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(z_{10}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{136}} = \left(x_{10}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_{10}-\tfrac{1}{2}\right)\mathbf{a}_2 - z_{10}\,\mathbf{a}_3 = a\left(x_{10}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(y_{10}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - az_{10}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{137}} = z_{10}\,\mathbf{a}_1 + x_{10}\,\mathbf{a}_2 + y_{10}\,\mathbf{a}_3 = az_{10}\,\hat{\mathbf{x}} + ax_{10}\,\hat{\mathbf{y}} + ay_{10}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{138}} = \left(z_{10}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(x_{10}-\tfrac{1}{2}\right)\mathbf{a}_2 - y_{10}\,\mathbf{a}_3 = a\left(z_{10}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(x_{10}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - ay_{10}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{139}} = -\left(z_{10}-\tfrac{1}{2}\right)\mathbf{a}_1 - x_{10}\,\mathbf{a}_2 + \left(y_{10}+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(z_{10}-\tfrac{1}{2}\right)\hat{\mathbf{x}} - ax_{10}\,\hat{\mathbf{y}} + a\left(y_{10}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{140}} = -z_{10}\,\mathbf{a}_1 + \left(x_{10}+\tfrac{1}{2}\right)\mathbf{a}_2 - \left(y_{10}-\tfrac{1}{2}\right)\mathbf{a}_3 = -az_{10}\,\hat{\mathbf{x}} + a\left(x_{10}+\tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(y_{10}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{141}} = y_{10}\,\mathbf{a}_1 + z_{10}\,\mathbf{a}_2 + x_{10}\,\mathbf{a}_3 = ay_{10}\,\hat{\mathbf{x}} + az_{10}\,\hat{\mathbf{y}} + ax_{10}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{142}} = -y_{10}\,\mathbf{a}_1 + \left(z_{10}+\tfrac{1}{2}\right)\mathbf{a}_2 - \left(x_{10}-\tfrac{1}{2}\right)\mathbf{a}_3 = -ay_{10}\,\hat{\mathbf{x}} + a\left(z_{10}+\tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(x_{10}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{143}} = \left(y_{10}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(z_{10}-\tfrac{1}{2}\right)\mathbf{a}_2 - x_{10}\,\mathbf{a}_3 = a\left(y_{10}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(z_{10}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - ax_{10}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{144}} = -\left(y_{10}-\tfrac{1}{2}\right)\mathbf{a}_1 - z_{10}\,\mathbf{a}_2 + \left(x_{10}+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(y_{10}-\tfrac{1}{2}\right)\hat{\mathbf{x}} - az_{10}\,\hat{\mathbf{y}} + a\left(x_{10}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{145}} = -x_{10}\,\mathbf{a}_1 - y_{10}\,\mathbf{a}_2 - z_{10}\,\mathbf{a}_3 = -ax_{10}\,\hat{\mathbf{x}} - ay_{10}\,\hat{\mathbf{y}} - az_{10}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{146}} = \left(x_{10}+\tfrac{1}{2}\right)\mathbf{a}_1 + y_{10}\,\mathbf{a}_2 - \left(z_{10}-\tfrac{1}{2}\right)\mathbf{a}_3 = a\left(x_{10}+\tfrac{1}{2}\right)\hat{\mathbf{x}} + ay_{10}\,\hat{\mathbf{y}} - a\left(z_{10}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{147}} = x_{10}\,\mathbf{a}_1 - \left(y_{10}-\tfrac{1}{2}\right)\mathbf{a}_2 + \left(z_{10}+\tfrac{1}{2}\right)\mathbf{a}_3 = ax_{10}\,\hat{\mathbf{x}} - a\left(y_{10}-\tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(z_{10}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{148}} = -\left(x_{10}-\tfrac{1}{2}\right)\mathbf{a}_1 + \left(y_{10}+\tfrac{1}{2}\right)\mathbf{a}_2 + z_{10}\,\mathbf{a}_3 = -a\left(x_{10}-\tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(y_{10}+\tfrac{1}{2}\right)\hat{\mathbf{y}} + az_{10}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{149}} = -z_{10}\,\mathbf{a}_1 - x_{10}\,\mathbf{a}_2 - y_{10}\,\mathbf{a}_3 = -az_{10}\,\hat{\mathbf{x}} - ax_{10}\,\hat{\mathbf{y}} - ay_{10}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{150}} = -\left(z_{10}-\tfrac{1}{2}\right)\mathbf{a}_1 + \left(x_{10}+\tfrac{1}{2}\right)\mathbf{a}_2 + y_{10}\,\mathbf{a}_3 = -a\left(z_{10}-\tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(x_{10}+\tfrac{1}{2}\right)\hat{\mathbf{y}} + ay_{10}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{151}} = \left(z_{10}+\tfrac{1}{2}\right)\mathbf{a}_1 + x_{10}\,\mathbf{a}_2 - \left(y_{10}-\tfrac{1}{2}\right)\mathbf{a}_3 = a\left(z_{10}+\tfrac{1}{2}\right)\hat{\mathbf{x}} + ax_{10}\,\hat{\mathbf{y}} - a\left(y_{10}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{152}} = z_{10}\,\mathbf{a}_1 - \left(x_{10}-\tfrac{1}{2}\right)\mathbf{a}_2 + \left(y_{10}+\tfrac{1}{2}\right)\mathbf{a}_3 = az_{10}\,\hat{\mathbf{x}} - a\left(x_{10}-\tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(y_{10}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{153}} = -y_{10}\,\mathbf{a}_1 - z_{10}\,\mathbf{a}_2 - x_{10}\,\mathbf{a}_3 = -ay_{10}\,\hat{\mathbf{x}} - az_{10}\,\hat{\mathbf{y}} - ax_{10}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{154}} = y_{10}\,\mathbf{a}_1 - \left(z_{10}-\tfrac{1}{2}\right)\mathbf{a}_2 + \left(x_{10}+\tfrac{1}{2}\right)\mathbf{a}_3 = ay_{10}\,\hat{\mathbf{x}} - a\left(z_{10}-\tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(x_{10}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{155}} = -\left(y_{10}-\tfrac{1}{2}\right)\mathbf{a}_1 + \left(z_{10}+\tfrac{1}{2}\right)\mathbf{a}_2 + x_{10}\,\mathbf{a}_3 = -a\left(y_{10}-\tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(z_{10}+\tfrac{1}{2}\right)\hat{\mathbf{y}} + ax_{10}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{156}} = \left(y_{10}+\tfrac{1}{2}\right)\mathbf{a}_1 + z_{10}\,\mathbf{a}_2 - \left(x_{10}-\tfrac{1}{2}\right)\mathbf{a}_3 = a\left(y_{10}+\tfrac{1}{2}\right)\hat{\mathbf{x}} + az_{10}\,\hat{\mathbf{y}} - a\left(x_{10}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H V}$$

$$\mathbf{B_{157}} = x_{11}\,\mathbf{a}_1 + y_{11}\,\mathbf{a}_2 + z_{11}\,\mathbf{a}_3 = ax_{11}\,\hat{\mathbf{x}} + ay_{11}\,\hat{\mathbf{y}} + az_{11}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{158}} = -\left(x_{11}-\tfrac{1}{2}\right)\mathbf{a}_1 - y_{11}\,\mathbf{a}_2 + \left(z_{11}+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(x_{11}-\tfrac{1}{2}\right)\hat{\mathbf{x}} - ay_{11}\,\hat{\mathbf{y}} + a\left(z_{11}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{159}} = -x_{11}\,\mathbf{a}_1 + \left(y_{11}+\tfrac{1}{2}\right)\mathbf{a}_2 - \left(z_{11}-\tfrac{1}{2}\right)\mathbf{a}_3 = -ax_{11}\,\hat{\mathbf{x}} + a\left(y_{11}+\tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(z_{11}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{160}} = \left(x_{11}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_{11}-\tfrac{1}{2}\right)\mathbf{a}_2 - z_{11}\,\mathbf{a}_3 = a\left(x_{11}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(y_{11}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - az_{11}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{161}} = z_{11}\,\mathbf{a}_1 + x_{11}\,\mathbf{a}_2 + y_{11}\,\mathbf{a}_3 = az_{11}\,\hat{\mathbf{x}} + ax_{11}\,\hat{\mathbf{y}} + ay_{11}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{162}} = \left(z_{11}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(x_{11}-\tfrac{1}{2}\right)\mathbf{a}_2 - y_{11}\,\mathbf{a}_3 = a\left(z_{11}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(x_{11}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - ay_{11}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{163}} = -\left(z_{11}-\tfrac{1}{2}\right)\mathbf{a}_1 - x_{11}\,\mathbf{a}_2 + \left(y_{11}+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(z_{11}-\tfrac{1}{2}\right)\hat{\mathbf{x}} - ax_{11}\,\hat{\mathbf{y}} + a\left(y_{11}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{164}} = -z_{11}\,\mathbf{a}_1 + \left(x_{11}+\tfrac{1}{2}\right)\mathbf{a}_2 - \left(y_{11}-\tfrac{1}{2}\right)\mathbf{a}_3 = -az_{11}\,\hat{\mathbf{x}} + a\left(x_{11}+\tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(y_{11}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{165}} = y_{11}\,\mathbf{a}_1 + z_{11}\,\mathbf{a}_2 + x_{11}\,\mathbf{a}_3 = ay_{11}\,\hat{\mathbf{x}} + az_{11}\,\hat{\mathbf{y}} + ax_{11}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{166}} = -y_{11}\,\mathbf{a}_1 + \left(z_{11}+\tfrac{1}{2}\right)\mathbf{a}_2 - \left(x_{11}-\tfrac{1}{2}\right)\mathbf{a}_3 = -ay_{11}\,\hat{\mathbf{x}} + a\left(z_{11}+\tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(x_{11}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{167}} = \left(y_{11}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(z_{11}-\tfrac{1}{2}\right)\mathbf{a}_2 - x_{11}\,\mathbf{a}_3 = a\left(y_{11}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(z_{11}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - ax_{11}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{168}} = -\left(y_{11}-\tfrac{1}{2}\right)\mathbf{a}_1 - z_{11}\,\mathbf{a}_2 + \left(x_{11}+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(y_{11}-\tfrac{1}{2}\right)\hat{\mathbf{x}} - az_{11}\,\hat{\mathbf{y}} + a\left(x_{11}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{169}} = -x_{11}\,\mathbf{a}_1 - y_{11}\,\mathbf{a}_2 - z_{11}\,\mathbf{a}_3 = -ax_{11}\,\hat{\mathbf{x}} - ay_{11}\,\hat{\mathbf{y}} - az_{11}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{170}} = \left(x_{11}+\tfrac{1}{2}\right)\mathbf{a}_1 + y_{11}\,\mathbf{a}_2 - \left(z_{11}-\tfrac{1}{2}\right)\mathbf{a}_3 = a\left(x_{11}+\tfrac{1}{2}\right)\hat{\mathbf{x}} + ay_{11}\,\hat{\mathbf{y}} - a\left(z_{11}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{171}} = x_{11}\,\mathbf{a}_1 - \left(y_{11}-\tfrac{1}{2}\right)\mathbf{a}_2 + \left(z_{11}+\tfrac{1}{2}\right)\mathbf{a}_3 = ax_{11}\,\hat{\mathbf{x}} - a\left(y_{11}-\tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(z_{11}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{172}} = -\left(x_{11}-\tfrac{1}{2}\right)\mathbf{a}_1 + \left(y_{11}+\tfrac{1}{2}\right)\mathbf{a}_2 + z_{11}\,\mathbf{a}_3 = -a\left(x_{11}-\tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(y_{11}+\tfrac{1}{2}\right)\hat{\mathbf{y}} + az_{11}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{173}} = -z_{11}\,\mathbf{a}_1 - x_{11}\,\mathbf{a}_2 - y_{11}\,\mathbf{a}_3 = -az_{11}\,\hat{\mathbf{x}} - ax_{11}\,\hat{\mathbf{y}} - ay_{11}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{174}} = -\left(z_{11}-\tfrac{1}{2}\right)\mathbf{a}_1 + \left(x_{11}+\tfrac{1}{2}\right)\mathbf{a}_2 + y_{11}\,\mathbf{a}_3 = -a\left(z_{11}-\tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(x_{11}+\tfrac{1}{2}\right)\hat{\mathbf{y}} + ay_{11}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{175}} = \left(z_{11}+\tfrac{1}{2}\right)\mathbf{a}_1 + x_{11}\,\mathbf{a}_2 - \left(y_{11}-\tfrac{1}{2}\right)\mathbf{a}_3 = a\left(z_{11}+\tfrac{1}{2}\right)\hat{\mathbf{x}} + ax_{11}\,\hat{\mathbf{y}} - a\left(y_{11}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{176}} = z_{11}\,\mathbf{a}_1 - \left(x_{11}-\tfrac{1}{2}\right)\mathbf{a}_2 + \left(y_{11}+\tfrac{1}{2}\right)\mathbf{a}_3 = az_{11}\,\hat{\mathbf{x}} - a\left(x_{11}-\tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(y_{11}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{177}} = -y_{11}\,\mathbf{a}_1 - z_{11}\,\mathbf{a}_2 - x_{11}\,\mathbf{a}_3 = -ay_{11}\,\hat{\mathbf{x}} - az_{11}\,\hat{\mathbf{y}} - ax_{11}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{178}} = y_{11}\,\mathbf{a}_1 - \left(z_{11}-\tfrac{1}{2}\right)\mathbf{a}_2 + \left(x_{11}+\tfrac{1}{2}\right)\mathbf{a}_3 = ay_{11}\,\hat{\mathbf{x}} - a\left(z_{11}-\tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(x_{11}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{179}} = -\left(y_{11}-\tfrac{1}{2}\right)\mathbf{a}_1 + \left(z_{11}+\tfrac{1}{2}\right)\mathbf{a}_2 + x_{11}\,\mathbf{a}_3 = -a\left(y_{11}-\tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(z_{11}+\tfrac{1}{2}\right)\hat{\mathbf{y}} + ax_{11}\,\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{180}} = \left(y_{11}+\tfrac{1}{2}\right)\mathbf{a}_1 + z_{11}\,\mathbf{a}_2 - \left(x_{11}-\tfrac{1}{2}\right)\mathbf{a}_3 = a\left(y_{11}+\tfrac{1}{2}\right)\hat{\mathbf{x}} + az_{11}\,\hat{\mathbf{y}} - a\left(x_{11}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{H VI}$$

$$\mathbf{B_{181}} = x_{12}\,\mathbf{a}_1 + y_{12}\,\mathbf{a}_2 + z_{12}\,\mathbf{a}_3 = ax_{12}\,\hat{\mathbf{x}} + ay_{12}\,\hat{\mathbf{y}} + az_{12}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{182}} = -\left(x_{12}-\tfrac{1}{2}\right)\mathbf{a}_1 - y_{12}\,\mathbf{a}_2 + \left(z_{12}+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(x_{12}-\tfrac{1}{2}\right)\hat{\mathbf{x}} - ay_{12}\,\hat{\mathbf{y}} + a\left(z_{12}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{183}} = -x_{12}\,\mathbf{a}_1 + \left(y_{12}+\tfrac{1}{2}\right)\mathbf{a}_2 - \left(z_{12}-\tfrac{1}{2}\right)\mathbf{a}_3 = -ax_{12}\,\hat{\mathbf{x}} + a\left(y_{12}+\tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(z_{12}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{184}} = \left(x_{12}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_{12}-\tfrac{1}{2}\right)\mathbf{a}_2 - z_{12}\,\mathbf{a}_3 = a\left(x_{12}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(y_{12}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - az_{12}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{185}} = z_{12}\,\mathbf{a}_1 + x_{12}\,\mathbf{a}_2 + y_{12}\,\mathbf{a}_3 = az_{12}\,\hat{\mathbf{x}} + ax_{12}\,\hat{\mathbf{y}} + ay_{12}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{186}} = \left(z_{12}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(x_{12}-\tfrac{1}{2}\right)\mathbf{a}_2 - y_{12}\,\mathbf{a}_3 = a\left(z_{12}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(x_{12}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - ay_{12}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{187}} = -\left(z_{12}-\tfrac{1}{2}\right)\mathbf{a}_1 - x_{12}\,\mathbf{a}_2 + \left(y_{12}+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(z_{12}-\tfrac{1}{2}\right)\hat{\mathbf{x}} - ax_{12}\,\hat{\mathbf{y}} + a\left(y_{12}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{188}} = -z_{12}\,\mathbf{a}_1 + \left(x_{12}+\tfrac{1}{2}\right)\mathbf{a}_2 - \left(y_{12}-\tfrac{1}{2}\right)\mathbf{a}_3 = -az_{12}\,\hat{\mathbf{x}} + a\left(x_{12}+\tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(y_{12}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{189}} = y_{12}\,\mathbf{a}_1 + z_{12}\,\mathbf{a}_2 + x_{12}\,\mathbf{a}_3 = ay_{12}\,\hat{\mathbf{x}} + az_{12}\,\hat{\mathbf{y}} + ax_{12}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{190}} = -y_{12}\,\mathbf{a}_1 + \left(z_{12}+\tfrac{1}{2}\right)\mathbf{a}_2 - \left(x_{12}-\tfrac{1}{2}\right)\mathbf{a}_3 = -ay_{12}\,\hat{\mathbf{x}} + a\left(z_{12}+\tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(x_{12}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{191}} = \left(y_{12}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(z_{12}-\tfrac{1}{2}\right)\mathbf{a}_2 - x_{12}\,\mathbf{a}_3 = a\left(y_{12}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(z_{12}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - ax_{12}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{192}} = -\left(y_{12}-\tfrac{1}{2}\right)\mathbf{a}_1 - z_{12}\,\mathbf{a}_2 + \left(x_{12}+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(y_{12}-\tfrac{1}{2}\right)\hat{\mathbf{x}} - az_{12}\,\hat{\mathbf{y}} + a\left(x_{12}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{193}} = -x_{12}\,\mathbf{a}_1 - y_{12}\,\mathbf{a}_2 - z_{12}\,\mathbf{a}_3 = -ax_{12}\,\hat{\mathbf{x}} - ay_{12}\,\hat{\mathbf{y}} - az_{12}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{194}} = \left(x_{12}+\tfrac{1}{2}\right)\mathbf{a}_1 + y_{12}\,\mathbf{a}_2 - \left(z_{12}-\tfrac{1}{2}\right)\mathbf{a}_3 = a\left(x_{12}+\tfrac{1}{2}\right)\hat{\mathbf{x}} + ay_{12}\,\hat{\mathbf{y}} - a\left(z_{12}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{195}} = x_{12}\,\mathbf{a}_1 - \left(y_{12}-\tfrac{1}{2}\right)\mathbf{a}_2 + \left(z_{12}+\tfrac{1}{2}\right)\mathbf{a}_3 = ax_{12}\,\hat{\mathbf{x}} - a\left(y_{12}-\tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(z_{12}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{196}} = -\left(x_{12}-\tfrac{1}{2}\right)\mathbf{a}_1 + \left(y_{12}+\tfrac{1}{2}\right)\mathbf{a}_2 + z_{12}\,\mathbf{a}_3 = -a\left(x_{12}-\tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(y_{12}+\tfrac{1}{2}\right)\hat{\mathbf{y}} + az_{12}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{197}} = -z_{12}\,\mathbf{a}_1 - x_{12}\,\mathbf{a}_2 - y_{12}\,\mathbf{a}_3 = -az_{12}\,\hat{\mathbf{x}} - ax_{12}\,\hat{\mathbf{y}} - ay_{12}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{198}} = -\left(z_{12}-\tfrac{1}{2}\right)\mathbf{a}_1 + \left(x_{12}+\tfrac{1}{2}\right)\mathbf{a}_2 + y_{12}\,\mathbf{a}_3 = -a\left(z_{12}-\tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(x_{12}+\tfrac{1}{2}\right)\hat{\mathbf{y}} + ay_{12}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{199}} = \left(z_{12}+\tfrac{1}{2}\right)\mathbf{a}_1 + x_{12}\,\mathbf{a}_2 - \left(y_{12}-\tfrac{1}{2}\right)\mathbf{a}_3 = a\left(z_{12}+\tfrac{1}{2}\right)\hat{\mathbf{x}} + ax_{12}\,\hat{\mathbf{y}} - a\left(y_{12}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{200}} = z_{12}\,\mathbf{a}_1 - \left(x_{12}-\tfrac{1}{2}\right)\mathbf{a}_2 + \left(y_{12}+\tfrac{1}{2}\right)\mathbf{a}_3 = az_{12}\,\hat{\mathbf{x}} - a\left(x_{12}-\tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(y_{12}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{201}} = -y_{12}\,\mathbf{a}_1 - z_{12}\,\mathbf{a}_2 - x_{12}\,\mathbf{a}_3 = -ay_{12}\,\hat{\mathbf{x}} - az_{12}\,\hat{\mathbf{y}} - ax_{12}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{202}} = y_{12}\,\mathbf{a}_1 - \left(z_{12}-\tfrac{1}{2}\right)\mathbf{a}_2 + \left(x_{12}+\tfrac{1}{2}\right)\mathbf{a}_3 = ay_{12}\,\hat{\mathbf{x}} - a\left(z_{12}-\tfrac{1}{2}\right)\hat{\mathbf{y}} + a\left(x_{12}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{203}} = -\left(y_{12}-\tfrac{1}{2}\right)\mathbf{a}_1 + \left(z_{12}+\tfrac{1}{2}\right)\mathbf{a}_2 + x_{12}\,\mathbf{a}_3 = -a\left(y_{12}-\tfrac{1}{2}\right)\hat{\mathbf{x}} + a\left(z_{12}+\tfrac{1}{2}\right)\hat{\mathbf{y}} + ax_{12}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{204}} = \left(y_{12}+\tfrac{1}{2}\right)\mathbf{a}_1 + z_{12}\,\mathbf{a}_2 - \left(x_{12}-\tfrac{1}{2}\right)\mathbf{a}_3 = a\left(y_{12}+\tfrac{1}{2}\right)\hat{\mathbf{x}} + az_{12}\,\hat{\mathbf{y}} - a\left(x_{12}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{O II}$$

$$\mathbf{B_{205}} = x_{13}\,\mathbf{a}_1 + y_{13}\,\mathbf{a}_2 + z_{13}\,\mathbf{a}_3 = ax_{13}\,\hat{\mathbf{x}} + ay_{13}\,\hat{\mathbf{y}} + az_{13}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O III}$$

$$\mathbf{B_{206}} = -\left(x_{13}-\tfrac{1}{2}\right)\mathbf{a}_1 - y_{13}\,\mathbf{a}_2 + \left(z_{13}+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(x_{13}-\tfrac{1}{2}\right)\hat{\mathbf{x}} - ay_{13}\,\hat{\mathbf{y}} + a\left(z_{13}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{O III}$$

$$\mathbf{B_{207}} = -x_{13}\,\mathbf{a}_1 + \left(y_{13}+\tfrac{1}{2}\right)\mathbf{a}_2 - \left(z_{13}-\tfrac{1}{2}\right)\mathbf{a}_3 = -ax_{13}\,\hat{\mathbf{x}} + a\left(y_{13}+\tfrac{1}{2}\right)\hat{\mathbf{y}} - a\left(z_{13}-\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{O III}$$

$$\mathbf{B_{208}} = \left(x_{13}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(y_{13}-\tfrac{1}{2}\right)\mathbf{a}_2 - z_{13}\,\mathbf{a}_3 = a\left(x_{13}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(y_{13}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - az_{13}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O III}$$

$$\mathbf{B_{209}} = z_{13}\,\mathbf{a}_1 + x_{13}\,\mathbf{a}_2 + y_{13}\,\mathbf{a}_3 = az_{13}\,\hat{\mathbf{x}} + ax_{13}\,\hat{\mathbf{y}} + ay_{13}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O III}$$

$$\mathbf{B_{210}} = \left(z_{13}+\tfrac{1}{2}\right)\mathbf{a}_1 - \left(x_{13}-\tfrac{1}{2}\right)\mathbf{a}_2 - y_{13}\,\mathbf{a}_3 = a\left(z_{13}+\tfrac{1}{2}\right)\hat{\mathbf{x}} - a\left(x_{13}-\tfrac{1}{2}\right)\hat{\mathbf{y}} - ay_{13}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O III}$$

$$\mathbf{B_{211}} = -\left(z_{13}-\tfrac{1}{2}\right)\mathbf{a}_1 - x_{13}\,\mathbf{a}_2 + \left(y_{13}+\tfrac{1}{2}\right)\mathbf{a}_3 = -a\left(z_{13}-\tfrac{1}{2}\right)\hat{\mathbf{x}} - ax_{13}\,\hat{\mathbf{y}} + a\left(y_{13}+\tfrac{1}{2}\right)\hat{\mathbf{z}} \quad (24d) \quad \text{O III}$$

$\mathbf{B_{212}} = -z_{13}\,\mathbf{a}_1 + \left(x_{13}+\frac{1}{2}\right)\,\mathbf{a}_2 - \left(y_{13}-\frac{1}{2}\right)\,\mathbf{a}_3 = -az_{13}\,\hat{\mathbf{x}} + a\left(x_{13}+\frac{1}{2}\right)\,\hat{\mathbf{y}} - a\left(y_{13}-\frac{1}{2}\right)\,\hat{\mathbf{z}}$ (24d) O III

$\mathbf{B_{213}} = y_{13}\,\mathbf{a}_1 + z_{13}\,\mathbf{a}_2 + x_{13}\,\mathbf{a}_3 = ay_{13}\,\hat{\mathbf{x}} + az_{13}\,\hat{\mathbf{y}} + ax_{13}\,\hat{\mathbf{z}}$ (24d) O III

$\mathbf{B_{214}} = -y_{13}\,\mathbf{a}_1 + \left(z_{13}+\frac{1}{2}\right)\,\mathbf{a}_2 - \left(x_{13}-\frac{1}{2}\right)\,\mathbf{a}_3 = -ay_{13}\,\hat{\mathbf{x}} + a\left(z_{13}+\frac{1}{2}\right)\,\hat{\mathbf{y}} - a\left(x_{13}-\frac{1}{2}\right)\,\hat{\mathbf{z}}$ (24d) O III

$\mathbf{B_{215}} = \left(y_{13}+\frac{1}{2}\right)\,\mathbf{a}_1 - \left(z_{13}-\frac{1}{2}\right)\,\mathbf{a}_2 - x_{13}\,\mathbf{a}_3 = a\left(y_{13}+\frac{1}{2}\right)\,\hat{\mathbf{x}} - a\left(z_{13}-\frac{1}{2}\right)\,\hat{\mathbf{y}} - ax_{13}\,\hat{\mathbf{z}}$ (24d) O III

$\mathbf{B_{216}} = -\left(y_{13}-\frac{1}{2}\right)\,\mathbf{a}_1 - z_{13}\,\mathbf{a}_2 + \left(x_{13}+\frac{1}{2}\right)\,\mathbf{a}_3 = -a\left(y_{13}-\frac{1}{2}\right)\,\hat{\mathbf{x}} - az_{13}\,\hat{\mathbf{y}} + a\left(x_{13}+\frac{1}{2}\right)\,\hat{\mathbf{z}}$ (24d) O III

$\mathbf{B_{217}} = -x_{13}\,\mathbf{a}_1 - y_{13}\,\mathbf{a}_2 - z_{13}\,\mathbf{a}_3 = -ax_{13}\,\hat{\mathbf{x}} - ay_{13}\,\hat{\mathbf{y}} - az_{13}\,\hat{\mathbf{z}}$ (24d) O III

$\mathbf{B_{218}} = \left(x_{13}+\frac{1}{2}\right)\,\mathbf{a}_1 + y_{13}\,\mathbf{a}_2 - \left(z_{13}-\frac{1}{2}\right)\,\mathbf{a}_3 = a\left(x_{13}+\frac{1}{2}\right)\,\hat{\mathbf{x}} + ay_{13}\,\hat{\mathbf{y}} - a\left(z_{13}-\frac{1}{2}\right)\,\hat{\mathbf{z}}$ (24d) O III

$\mathbf{B_{219}} = x_{13}\,\mathbf{a}_1 - \left(y_{13}-\frac{1}{2}\right)\,\mathbf{a}_2 + \left(z_{13}+\frac{1}{2}\right)\,\mathbf{a}_3 = ax_{13}\,\hat{\mathbf{x}} - a\left(y_{13}-\frac{1}{2}\right)\,\hat{\mathbf{y}} + a\left(z_{13}+\frac{1}{2}\right)\,\hat{\mathbf{z}}$ (24d) O III

$\mathbf{B_{220}} = -\left(x_{13}-\frac{1}{2}\right)\,\mathbf{a}_1 + \left(y_{13}+\frac{1}{2}\right)\,\mathbf{a}_2 + z_{13}\,\mathbf{a}_3 = -a\left(x_{13}-\frac{1}{2}\right)\,\hat{\mathbf{x}} + a\left(y_{13}+\frac{1}{2}\right)\,\hat{\mathbf{y}} + az_{13}\,\hat{\mathbf{z}}$ (24d) O III

$\mathbf{B_{221}} = -z_{13}\,\mathbf{a}_1 - x_{13}\,\mathbf{a}_2 - y_{13}\,\mathbf{a}_3 = -az_{13}\,\hat{\mathbf{x}} - ax_{13}\,\hat{\mathbf{y}} - ay_{13}\,\hat{\mathbf{z}}$ (24d) O III

$\mathbf{B_{222}} = -\left(z_{13}-\frac{1}{2}\right)\,\mathbf{a}_1 + \left(x_{13}+\frac{1}{2}\right)\,\mathbf{a}_2 + y_{13}\,\mathbf{a}_3 = -a\left(z_{13}-\frac{1}{2}\right)\,\hat{\mathbf{x}} + a\left(x_{13}+\frac{1}{2}\right)\,\hat{\mathbf{y}} + ay_{13}\,\hat{\mathbf{z}}$ (24d) O III

$\mathbf{B_{223}} = \left(z_{13}+\frac{1}{2}\right)\,\mathbf{a}_1 + x_{13}\,\mathbf{a}_2 - \left(y_{13}-\frac{1}{2}\right)\,\mathbf{a}_3 = a\left(z_{13}+\frac{1}{2}\right)\,\hat{\mathbf{x}} + ax_{13}\,\hat{\mathbf{y}} - a\left(y_{13}-\frac{1}{2}\right)\,\hat{\mathbf{z}}$ (24d) O III

$\mathbf{B_{224}} = z_{13}\,\mathbf{a}_1 - \left(x_{13}-\frac{1}{2}\right)\,\mathbf{a}_2 + \left(y_{13}+\frac{1}{2}\right)\,\mathbf{a}_3 = az_{13}\,\hat{\mathbf{x}} - a\left(x_{13}-\frac{1}{2}\right)\,\hat{\mathbf{y}} + a\left(y_{13}+\frac{1}{2}\right)\,\hat{\mathbf{z}}$ (24d) O III

$\mathbf{B_{225}} = -y_{13}\,\mathbf{a}_1 - z_{13}\,\mathbf{a}_2 - x_{13}\,\mathbf{a}_3 = -ay_{13}\,\hat{\mathbf{x}} - az_{13}\,\hat{\mathbf{y}} - ax_{13}\,\hat{\mathbf{z}}$ (24d) O III

$\mathbf{B_{226}} = y_{13}\,\mathbf{a}_1 - \left(z_{13}-\frac{1}{2}\right)\,\mathbf{a}_2 + \left(x_{13}+\frac{1}{2}\right)\,\mathbf{a}_3 = ay_{13}\,\hat{\mathbf{x}} - a\left(z_{13}-\frac{1}{2}\right)\,\hat{\mathbf{y}} + a\left(x_{13}+\frac{1}{2}\right)\,\hat{\mathbf{z}}$ (24d) O III

$\mathbf{B_{227}} = -\left(y_{13}-\frac{1}{2}\right)\,\mathbf{a}_1 + \left(z_{13}+\frac{1}{2}\right)\,\mathbf{a}_2 + x_{13}\,\mathbf{a}_3 = -a\left(y_{13}-\frac{1}{2}\right)\,\hat{\mathbf{x}} + a\left(z_{13}+\frac{1}{2}\right)\,\hat{\mathbf{y}} + ax_{13}\,\hat{\mathbf{z}}$ (24d) O III

$\mathbf{B_{228}} = \left(y_{13}+\frac{1}{2}\right)\,\mathbf{a}_1 + z_{13}\,\mathbf{a}_2 - \left(x_{13}-\frac{1}{2}\right)\,\mathbf{a}_3 = a\left(y_{13}+\frac{1}{2}\right)\,\hat{\mathbf{x}} + az_{13}\,\hat{\mathbf{y}} - a\left(x_{13}-\frac{1}{2}\right)\,\hat{\mathbf{z}}$ (24d) O III

$\mathbf{B_{229}} = x_{14}\,\mathbf{a}_1 + y_{14}\,\mathbf{a}_2 + z_{14}\,\mathbf{a}_3 = ax_{14}\,\hat{\mathbf{x}} + ay_{14}\,\hat{\mathbf{y}} + az_{14}\,\hat{\mathbf{z}}$ (24d) O IV

$\mathbf{B_{230}} = -\left(x_{14}-\frac{1}{2}\right)\,\mathbf{a}_1 - y_{14}\,\mathbf{a}_2 + \left(z_{14}+\frac{1}{2}\right)\,\mathbf{a}_3 = -a\left(x_{14}-\frac{1}{2}\right)\,\hat{\mathbf{x}} - ay_{14}\,\hat{\mathbf{y}} + a\left(z_{14}+\frac{1}{2}\right)\,\hat{\mathbf{z}}$ (24d) O IV

$\mathbf{B_{231}} = -x_{14}\,\mathbf{a}_1 + \left(y_{14}+\frac{1}{2}\right)\,\mathbf{a}_2 - \left(z_{14}-\frac{1}{2}\right)\,\mathbf{a}_3 = -ax_{14}\,\hat{\mathbf{x}} + a\left(y_{14}+\frac{1}{2}\right)\,\hat{\mathbf{y}} - a\left(z_{14}-\frac{1}{2}\right)\,\hat{\mathbf{z}}$ (24d) O IV

$\mathbf{B_{232}} = \left(x_{14}+\frac{1}{2}\right)\,\mathbf{a}_1 - \left(y_{14}-\frac{1}{2}\right)\,\mathbf{a}_2 - z_{14}\,\mathbf{a}_3 = a\left(x_{14}+\frac{1}{2}\right)\,\hat{\mathbf{x}} - a\left(y_{14}-\frac{1}{2}\right)\,\hat{\mathbf{y}} - az_{14}\,\hat{\mathbf{z}}$ (24d) O IV

$\mathbf{B_{233}} = z_{14}\,\mathbf{a}_1 + x_{14}\,\mathbf{a}_2 + y_{14}\,\mathbf{a}_3 = az_{14}\,\hat{\mathbf{x}} + ax_{14}\,\hat{\mathbf{y}} + ay_{14}\,\hat{\mathbf{z}}$ (24d) O IV

$\mathbf{B_{234}} = \left(z_{14}+\frac{1}{2}\right)\,\mathbf{a}_1 - \left(x_{14}-\frac{1}{2}\right)\,\mathbf{a}_2 - y_{14}\,\mathbf{a}_3 = a\left(z_{14}+\frac{1}{2}\right)\,\hat{\mathbf{x}} - a\left(x_{14}-\frac{1}{2}\right)\,\hat{\mathbf{y}} - ay_{14}\,\hat{\mathbf{z}}$ (24d) O IV

$\mathbf{B_{235}} = -\left(z_{14}-\frac{1}{2}\right)\,\mathbf{a}_1 - x_{14}\,\mathbf{a}_2 + \left(y_{14}+\frac{1}{2}\right)\,\mathbf{a}_3 = -a\left(z_{14}-\frac{1}{2}\right)\,\hat{\mathbf{x}} - ax_{14}\,\hat{\mathbf{y}} + a\left(y_{14}+\frac{1}{2}\right)\,\hat{\mathbf{z}}$ (24d) O IV

$\mathbf{B_{236}} = -z_{14}\,\mathbf{a}_1 + \left(x_{14}+\frac{1}{2}\right)\,\mathbf{a}_2 - \left(y_{14}-\frac{1}{2}\right)\,\mathbf{a}_3 = -az_{14}\,\hat{\mathbf{x}} + a\left(x_{14}+\frac{1}{2}\right)\,\hat{\mathbf{y}} - a\left(y_{14}-\frac{1}{2}\right)\,\hat{\mathbf{z}}$ (24d) O IV

$\mathbf{B_{237}} = y_{14}\,\mathbf{a}_1 + z_{14}\,\mathbf{a}_2 + x_{14}\,\mathbf{a}_3 = ay_{14}\,\hat{\mathbf{x}} + az_{14}\,\hat{\mathbf{y}} + ax_{14}\,\hat{\mathbf{z}}$ (24d) O IV

$$\mathbf{B_{238}} = -y_{14}\,\mathbf{a}_1 + \left(z_{14}+\tfrac{1}{2}\right)\,\mathbf{a}_2 - \left(x_{14}-\tfrac{1}{2}\right)\,\mathbf{a}_3 = -ay_{14}\,\hat{\mathbf{x}} + a\left(z_{14}+\tfrac{1}{2}\right)\,\hat{\mathbf{y}} - a\left(x_{14}-\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{O IV}$$

$$\mathbf{B_{239}} = \left(y_{14}+\tfrac{1}{2}\right)\,\mathbf{a}_1 - \left(z_{14}-\tfrac{1}{2}\right)\,\mathbf{a}_2 - x_{14}\,\mathbf{a}_3 = a\left(y_{14}+\tfrac{1}{2}\right)\,\hat{\mathbf{x}} - a\left(z_{14}-\tfrac{1}{2}\right)\,\hat{\mathbf{y}} - ax_{14}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O IV}$$

$$\mathbf{B_{240}} = -\left(y_{14}-\tfrac{1}{2}\right)\,\mathbf{a}_1 - z_{14}\,\mathbf{a}_2 + \left(x_{14}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = -a\left(y_{14}-\tfrac{1}{2}\right)\,\hat{\mathbf{x}} - az_{14}\,\hat{\mathbf{y}} + a\left(x_{14}+\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{O IV}$$

$$\mathbf{B_{241}} = -x_{14}\,\mathbf{a}_1 - y_{14}\,\mathbf{a}_2 - z_{14}\,\mathbf{a}_3 = -ax_{14}\,\hat{\mathbf{x}} - ay_{14}\,\hat{\mathbf{y}} - az_{14}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O IV}$$

$$\mathbf{B_{242}} = \left(x_{14}+\tfrac{1}{2}\right)\,\mathbf{a}_1 + y_{14}\,\mathbf{a}_2 - \left(z_{14}-\tfrac{1}{2}\right)\,\mathbf{a}_3 = a\left(x_{14}+\tfrac{1}{2}\right)\,\hat{\mathbf{x}} + ay_{14}\,\hat{\mathbf{y}} - a\left(z_{14}-\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{O IV}$$

$$\mathbf{B_{243}} = x_{14}\,\mathbf{a}_1 - \left(y_{14}-\tfrac{1}{2}\right)\,\mathbf{a}_2 + \left(z_{14}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = ax_{14}\,\hat{\mathbf{x}} - a\left(y_{14}-\tfrac{1}{2}\right)\,\hat{\mathbf{y}} + a\left(z_{14}+\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{O IV}$$

$$\mathbf{B_{244}} = -\left(x_{14}-\tfrac{1}{2}\right)\,\mathbf{a}_1 + \left(y_{14}+\tfrac{1}{2}\right)\,\mathbf{a}_2 + z_{14}\,\mathbf{a}_3 = -a\left(x_{14}-\tfrac{1}{2}\right)\,\hat{\mathbf{x}} + a\left(y_{14}+\tfrac{1}{2}\right)\,\hat{\mathbf{y}} + az_{14}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O IV}$$

$$\mathbf{B_{245}} = -z_{14}\,\mathbf{a}_1 - x_{14}\,\mathbf{a}_2 - y_{14}\,\mathbf{a}_3 = -az_{14}\,\hat{\mathbf{x}} - ax_{14}\,\hat{\mathbf{y}} - ay_{14}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O IV}$$

$$\mathbf{B_{246}} = -\left(z_{14}-\tfrac{1}{2}\right)\,\mathbf{a}_1 + \left(x_{14}+\tfrac{1}{2}\right)\,\mathbf{a}_2 + y_{14}\,\mathbf{a}_3 = -a\left(z_{14}-\tfrac{1}{2}\right)\,\hat{\mathbf{x}} + a\left(x_{14}+\tfrac{1}{2}\right)\,\hat{\mathbf{y}} + ay_{14}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O IV}$$

$$\mathbf{B_{247}} = \left(z_{14}+\tfrac{1}{2}\right)\,\mathbf{a}_1 + x_{14}\,\mathbf{a}_2 - \left(y_{14}-\tfrac{1}{2}\right)\,\mathbf{a}_3 = a\left(z_{14}+\tfrac{1}{2}\right)\,\hat{\mathbf{x}} + ax_{14}\,\hat{\mathbf{y}} - a\left(y_{14}-\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{O IV}$$

$$\mathbf{B_{248}} = z_{14}\,\mathbf{a}_1 - \left(x_{14}-\tfrac{1}{2}\right)\,\mathbf{a}_2 + \left(y_{14}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = az_{14}\,\hat{\mathbf{x}} - a\left(x_{14}-\tfrac{1}{2}\right)\,\hat{\mathbf{y}} + a\left(y_{14}+\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{O IV}$$

$$\mathbf{B_{249}} = -y_{14}\,\mathbf{a}_1 - z_{14}\,\mathbf{a}_2 - x_{14}\,\mathbf{a}_3 = -ay_{14}\,\hat{\mathbf{x}} - az_{14}\,\hat{\mathbf{y}} - ax_{14}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O IV}$$

$$\mathbf{B_{250}} = y_{14}\,\mathbf{a}_1 - \left(z_{14}-\tfrac{1}{2}\right)\,\mathbf{a}_2 + \left(x_{14}+\tfrac{1}{2}\right)\,\mathbf{a}_3 = ay_{14}\,\hat{\mathbf{x}} - a\left(z_{14}-\tfrac{1}{2}\right)\,\hat{\mathbf{y}} + a\left(x_{14}+\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{O IV}$$

$$\mathbf{B_{251}} = -\left(y_{14}-\tfrac{1}{2}\right)\,\mathbf{a}_1 + \left(z_{14}+\tfrac{1}{2}\right)\,\mathbf{a}_2 + x_{14}\,\mathbf{a}_3 = -a\left(y_{14}-\tfrac{1}{2}\right)\,\hat{\mathbf{x}} + a\left(z_{14}+\tfrac{1}{2}\right)\,\hat{\mathbf{y}} + ax_{14}\,\hat{\mathbf{z}} \quad (24d) \quad \text{O IV}$$

$$\mathbf{B_{252}} = \left(y_{14}+\tfrac{1}{2}\right)\,\mathbf{a}_1 + z_{14}\,\mathbf{a}_2 - \left(x_{14}-\tfrac{1}{2}\right)\,\mathbf{a}_3 = a\left(y_{14}+\tfrac{1}{2}\right)\,\hat{\mathbf{x}} + az_{14}\,\hat{\mathbf{y}} - a\left(x_{14}-\tfrac{1}{2}\right)\,\hat{\mathbf{z}} \quad (24d) \quad \text{O IV}$$

## References


[1] A. M. Abdeen, G. Will, W. Schäfer, A. Kirfel, M. O. Bargouth, and K. Recker, *X-Ray and neutron diffraction study of alums*, Z. Krystallogr. **157**, 147–166 (1981), doi:10.1524/zkri.1981.157.14.147.

[2] H. Lipson, *Existence of Three Alum Structures*, Nature **135**, 912 (1935), doi:10.1038/135912b0.

[3] H. Lipson, *The Relation between the Alum Structures*, Proc. Roy. Soc. London **151**, 347–356 (1935), doi:10.1098/rspa.1935.0154.

[4] H. Lipson, *The structure of methyl ammonium alum, $NH_3(CH_3)Al(SO_4)_2{\cdot}12H_2O$*, Philosophical Magazine **19**, 887–901 (1935), doi:10.1080/14786443508561428.

[5] C. Gottfried and F. Schossberger, eds., *Strukturbericht Band III 1933-1935* (Akademische Verlagsgesellschaft M. B. H., Leipzig, 1937).

[6] A. H. C. Ledsham and H. Steeple, *The crystal structure of sodium chromium alum and caesium chromium alum*, Acta Crystallogr. Sect. B **24**, 1287–1289 (1968), doi:10.1107/S0567740868004188.

[7] R. O. W. Fletcher and H. Steeple, *The crystal structure of the low-temperature phase of methylammonium alum*, Acta Cryst. **17**, 290–294 (1964), doi:10.1107/S0365110X64000706.