

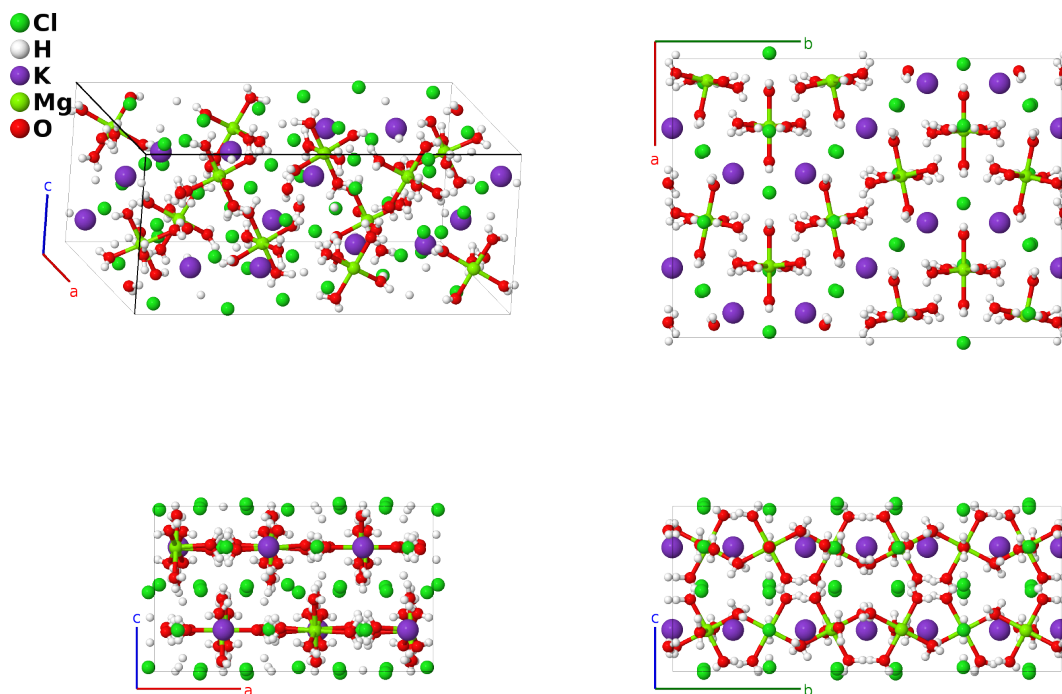
# Carnallite $[\text{Mg}(\text{H}_2\text{O})_6\text{KCl}_3]$ Structure: A3B12CDE6\_oP276\_52\_d4e\_18e\_ce\_de\_2d8e-001

This structure originally had the label A3B12CDE6\_oP276\_52\_d4e\_18e\_ce\_de\_2d8e. Calls to that address will be redirected here.

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<https://aflow.org/p/40W9>

[https://aflow.org/p/A3B12CDE6\\_oP276\\_52\\_d4e\\_18e\\_ce\\_de\\_2d8e-001](https://aflow.org/p/A3B12CDE6_oP276_52_d4e_18e_ce_de_2d8e-001)



Prototype	$\text{Cl}_3\text{H}_{12}\text{KMgO}_6$
AFLOW prototype label	A3B12CDE6_oP276_52_d4e_18e_ce_de_2d8e-001
Mineral name	carnallite
ICSD	64691
Pearson symbol	oP276
Space group number	52
Space group symbol	$Pnna$
AFLOW prototype command	<pre>aflow --proto=A3B12CDE6_oP276_52_d4e_18e_ce_de_2d8e-001 --params=a, b/a, c/a, z1, x2, x3, x4, x5, x6, y6, z6, x7, y7, z7, x8, y8, z8, x9, y9, z9, x10, y10, z10, x11, y11, z11, x12, y12, z12, x13, y13, z13, x14, y14, z14, x15, y15, z15, x16, y16, z16, x17, y17, z17, x18, y18, z18, x19, y19, z19, x20, y20, z20, x21, y21, z21, x22, y22, z22, x23, y23, z23, x24, y24, z24, x25, y25, z25, x26, y26, z26, x27, y27, z27, x28, y28, z28, x29, y29, z29, x30, y30, z30, x31, y31, z31, x32, y32, z32, x33, y33, z33, x34, y34, z34, x35, y35, z35, x36, y36, z36, x37, y37, z37</pre>

## Other compounds with this structure

$\text{Mg}(\text{H}_2\text{O})_6\text{K}(\text{Cl}, \text{Br})_3$

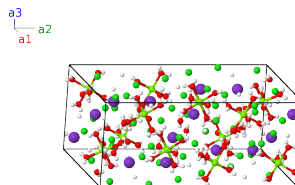
- (Andreß, 1939) determined the crystal structure of brom-carnallite,  $\text{Mg}(\text{H}_2\text{O})_6\text{K}(\text{Cl}, \text{Br})_3$ , finding that it was in space group  $P4/n$  #85. (Herrmann, 1939) gave this structure the *Strukturbericht* designation  $E2_6$ . Later, (Schlemper, 1985), determined that the true space group was  $Pnna$  #52, and were able to determine the positions of the hydrogen atoms in the water molecules. We present this structure here. For the original structure see the  $E2_6$  page.

## Simple Orthorhombic primitive vectors

$$\mathbf{a}_1 = a \hat{\mathbf{x}}$$

$$\mathbf{a}_2 = b \hat{\mathbf{y}}$$

$$\mathbf{a}_3 = c \hat{\mathbf{z}}$$



## Basis vectors

	Lattice coordinates		Cartesian coordinates	Wyckoff position	Atom type
$\mathbf{B}_1$	$= \frac{1}{4} \mathbf{a}_1 + z_1 \mathbf{a}_3$	$=$	$\frac{1}{4} a \hat{\mathbf{x}} + cz_1 \hat{\mathbf{z}}$	(4c)	K I
$\mathbf{B}_2$	$= \frac{1}{4} \mathbf{a}_1 + \frac{1}{2} \mathbf{a}_2 - (z_1 - \frac{1}{2}) \mathbf{a}_3$	$=$	$\frac{1}{4} a \hat{\mathbf{x}} + \frac{1}{2} b \hat{\mathbf{y}} - c(z_1 - \frac{1}{2}) \hat{\mathbf{z}}$	(4c)	K I
$\mathbf{B}_3$	$= \frac{3}{4} \mathbf{a}_1 - z_1 \mathbf{a}_3$	$=$	$\frac{3}{4} a \hat{\mathbf{x}} - cz_1 \hat{\mathbf{z}}$	(4c)	K I
$\mathbf{B}_4$	$= \frac{3}{4} \mathbf{a}_1 + \frac{1}{2} \mathbf{a}_2 + (z_1 + \frac{1}{2}) \mathbf{a}_3$	$=$	$\frac{3}{4} a \hat{\mathbf{x}} + \frac{1}{2} b \hat{\mathbf{y}} + c(z_1 + \frac{1}{2}) \hat{\mathbf{z}}$	(4c)	K I
$\mathbf{B}_5$	$= x_2 \mathbf{a}_1 + \frac{1}{4} \mathbf{a}_2 + \frac{1}{4} \mathbf{a}_3$	$=$	$ax_2 \hat{\mathbf{x}} + \frac{1}{4} b \hat{\mathbf{y}} + \frac{1}{4} c \hat{\mathbf{z}}$	(4d)	Cl I
$\mathbf{B}_6$	$= -(x_2 - \frac{1}{2}) \mathbf{a}_1 + \frac{3}{4} \mathbf{a}_2 + \frac{1}{4} \mathbf{a}_3$	$=$	$-a(x_2 - \frac{1}{2}) \hat{\mathbf{x}} + \frac{3}{4} b \hat{\mathbf{y}} + \frac{1}{4} c \hat{\mathbf{z}}$	(4d)	Cl I
$\mathbf{B}_7$	$= -x_2 \mathbf{a}_1 + \frac{3}{4} \mathbf{a}_2 + \frac{3}{4} \mathbf{a}_3$	$=$	$-ax_2 \hat{\mathbf{x}} + \frac{3}{4} b \hat{\mathbf{y}} + \frac{3}{4} c \hat{\mathbf{z}}$	(4d)	Cl I
$\mathbf{B}_8$	$= (x_2 + \frac{1}{2}) \mathbf{a}_1 + \frac{1}{4} \mathbf{a}_2 + \frac{3}{4} \mathbf{a}_3$	$=$	$a(x_2 + \frac{1}{2}) \hat{\mathbf{x}} + \frac{1}{4} b \hat{\mathbf{y}} + \frac{3}{4} c \hat{\mathbf{z}}$	(4d)	Cl I
$\mathbf{B}_9$	$= x_3 \mathbf{a}_1 + \frac{1}{4} \mathbf{a}_2 + \frac{1}{4} \mathbf{a}_3$	$=$	$ax_3 \hat{\mathbf{x}} + \frac{1}{4} b \hat{\mathbf{y}} + \frac{1}{4} c \hat{\mathbf{z}}$	(4d)	Mg I
$\mathbf{B}_{10}$	$= -(x_3 - \frac{1}{2}) \mathbf{a}_1 + \frac{3}{4} \mathbf{a}_2 + \frac{1}{4} \mathbf{a}_3$	$=$	$-a(x_3 - \frac{1}{2}) \hat{\mathbf{x}} + \frac{3}{4} b \hat{\mathbf{y}} + \frac{1}{4} c \hat{\mathbf{z}}$	(4d)	Mg I
$\mathbf{B}_{11}$	$= -x_3 \mathbf{a}_1 + \frac{3}{4} \mathbf{a}_2 + \frac{3}{4} \mathbf{a}_3$	$=$	$-ax_3 \hat{\mathbf{x}} + \frac{3}{4} b \hat{\mathbf{y}} + \frac{3}{4} c \hat{\mathbf{z}}$	(4d)	Mg I
$\mathbf{B}_{12}$	$= (x_3 + \frac{1}{2}) \mathbf{a}_1 + \frac{1}{4} \mathbf{a}_2 + \frac{3}{4} \mathbf{a}_3$	$=$	$a(x_3 + \frac{1}{2}) \hat{\mathbf{x}} + \frac{1}{4} b \hat{\mathbf{y}} + \frac{3}{4} c \hat{\mathbf{z}}$	(4d)	Mg I
$\mathbf{B}_{13}$	$= x_4 \mathbf{a}_1 + \frac{1}{4} \mathbf{a}_2 + \frac{1}{4} \mathbf{a}_3$	$=$	$ax_4 \hat{\mathbf{x}} + \frac{1}{4} b \hat{\mathbf{y}} + \frac{1}{4} c \hat{\mathbf{z}}$	(4d)	O I
$\mathbf{B}_{14}$	$= -(x_4 - \frac{1}{2}) \mathbf{a}_1 + \frac{3}{4} \mathbf{a}_2 + \frac{1}{4} \mathbf{a}_3$	$=$	$-a(x_4 - \frac{1}{2}) \hat{\mathbf{x}} + \frac{3}{4} b \hat{\mathbf{y}} + \frac{1}{4} c \hat{\mathbf{z}}$	(4d)	O I
$\mathbf{B}_{15}$	$= -x_4 \mathbf{a}_1 + \frac{3}{4} \mathbf{a}_2 + \frac{3}{4} \mathbf{a}_3$	$=$	$-ax_4 \hat{\mathbf{x}} + \frac{3}{4} b \hat{\mathbf{y}} + \frac{3}{4} c \hat{\mathbf{z}}$	(4d)	O I
$\mathbf{B}_{16}$	$= (x_4 + \frac{1}{2}) \mathbf{a}_1 + \frac{1}{4} \mathbf{a}_2 + \frac{3}{4} \mathbf{a}_3$	$=$	$a(x_4 + \frac{1}{2}) \hat{\mathbf{x}} + \frac{1}{4} b \hat{\mathbf{y}} + \frac{3}{4} c \hat{\mathbf{z}}$	(4d)	O I
$\mathbf{B}_{17}$	$= x_5 \mathbf{a}_1 + \frac{1}{4} \mathbf{a}_2 + \frac{1}{4} \mathbf{a}_3$	$=$	$ax_5 \hat{\mathbf{x}} + \frac{1}{4} b \hat{\mathbf{y}} + \frac{1}{4} c \hat{\mathbf{z}}$	(4d)	O II
$\mathbf{B}_{18}$	$= -(x_5 - \frac{1}{2}) \mathbf{a}_1 + \frac{3}{4} \mathbf{a}_2 + \frac{1}{4} \mathbf{a}_3$	$=$	$-a(x_5 - \frac{1}{2}) \hat{\mathbf{x}} + \frac{3}{4} b \hat{\mathbf{y}} + \frac{1}{4} c \hat{\mathbf{z}}$	(4d)	O II
$\mathbf{B}_{19}$	$= -x_5 \mathbf{a}_1 + \frac{3}{4} \mathbf{a}_2 + \frac{3}{4} \mathbf{a}_3$	$=$	$-ax_5 \hat{\mathbf{x}} + \frac{3}{4} b \hat{\mathbf{y}} + \frac{3}{4} c \hat{\mathbf{z}}$	(4d)	O II
$\mathbf{B}_{20}$	$= (x_5 + \frac{1}{2}) \mathbf{a}_1 + \frac{1}{4} \mathbf{a}_2 + \frac{3}{4} \mathbf{a}_3$	$=$	$a(x_5 + \frac{1}{2}) \hat{\mathbf{x}} + \frac{1}{4} b \hat{\mathbf{y}} + \frac{3}{4} c \hat{\mathbf{z}}$	(4d)	O II
$\mathbf{B}_{21}$	$= x_6 \mathbf{a}_1 + y_6 \mathbf{a}_2 + z_6 \mathbf{a}_3$	$=$	$ax_6 \hat{\mathbf{x}} + by_6 \hat{\mathbf{y}} + cz_6 \hat{\mathbf{z}}$	(8e)	Cl II
$\mathbf{B}_{22}$	$= -(x_6 - \frac{1}{2}) \mathbf{a}_1 - y_6 \mathbf{a}_2 + z_6 \mathbf{a}_3$	$=$	$-a(x_6 - \frac{1}{2}) \hat{\mathbf{x}} - by_6 \hat{\mathbf{y}} + cz_6 \hat{\mathbf{z}}$	(8e)	Cl II
$\mathbf{B}_{23}$	$= -(x_6 - \frac{1}{2}) \mathbf{a}_1 + (y_6 + \frac{1}{2}) \mathbf{a}_2 - (z_6 - \frac{1}{2}) \mathbf{a}_3$	$=$	$-a(x_6 - \frac{1}{2}) \hat{\mathbf{x}} + b(y_6 + \frac{1}{2}) \hat{\mathbf{y}} - c(z_6 - \frac{1}{2}) \hat{\mathbf{z}}$	(8e)	Cl II

$$\begin{aligned}
\mathbf{B}_{24} &= x_6 \mathbf{a}_1 - (y_6 - \frac{1}{2}) \mathbf{a}_2 - (z_6 - \frac{1}{2}) \mathbf{a}_3 = ax_6 \hat{\mathbf{x}} - b(y_6 - \frac{1}{2}) \hat{\mathbf{y}} - c(z_6 - \frac{1}{2}) \hat{\mathbf{z}} & (8e) & \text{Cl II} \\
\mathbf{B}_{25} &= -x_6 \mathbf{a}_1 - y_6 \mathbf{a}_2 - z_6 \mathbf{a}_3 = -ax_6 \hat{\mathbf{x}} - by_6 \hat{\mathbf{y}} - cz_6 \hat{\mathbf{z}} & (8e) & \text{Cl II} \\
\mathbf{B}_{26} &= (x_6 + \frac{1}{2}) \mathbf{a}_1 + y_6 \mathbf{a}_2 - z_6 \mathbf{a}_3 = a(x_6 + \frac{1}{2}) \hat{\mathbf{x}} + by_6 \hat{\mathbf{y}} - cz_6 \hat{\mathbf{z}} & (8e) & \text{Cl II} \\
\mathbf{B}_{27} &= (x_6 + \frac{1}{2}) \mathbf{a}_1 - (y_6 - \frac{1}{2}) \mathbf{a}_2 + (z_6 + \frac{1}{2}) \mathbf{a}_3 = a(x_6 + \frac{1}{2}) \hat{\mathbf{x}} - b(y_6 - \frac{1}{2}) \hat{\mathbf{y}} + c(z_6 + \frac{1}{2}) \hat{\mathbf{z}} & (8e) & \text{Cl II} \\
\mathbf{B}_{28} &= -x_6 \mathbf{a}_1 + (y_6 + \frac{1}{2}) \mathbf{a}_2 + (z_6 + \frac{1}{2}) \mathbf{a}_3 = -ax_6 \hat{\mathbf{x}} + b(y_6 + \frac{1}{2}) \hat{\mathbf{y}} + c(z_6 + \frac{1}{2}) \hat{\mathbf{z}} & (8e) & \text{Cl II} \\
\mathbf{B}_{29} &= x_7 \mathbf{a}_1 + y_7 \mathbf{a}_2 + z_7 \mathbf{a}_3 = ax_7 \hat{\mathbf{x}} + by_7 \hat{\mathbf{y}} + cz_7 \hat{\mathbf{z}} & (8e) & \text{Cl III} \\
\mathbf{B}_{30} &= -(x_7 - \frac{1}{2}) \mathbf{a}_1 - y_7 \mathbf{a}_2 + z_7 \mathbf{a}_3 = -a(x_7 - \frac{1}{2}) \hat{\mathbf{x}} - by_7 \hat{\mathbf{y}} + cz_7 \hat{\mathbf{z}} & (8e) & \text{Cl III} \\
\mathbf{B}_{31} &= -(x_7 - \frac{1}{2}) \mathbf{a}_1 + (y_7 + \frac{1}{2}) \mathbf{a}_2 - (z_7 - \frac{1}{2}) \mathbf{a}_3 = -a(x_7 - \frac{1}{2}) \hat{\mathbf{x}} + b(y_7 + \frac{1}{2}) \hat{\mathbf{y}} - c(z_7 - \frac{1}{2}) \hat{\mathbf{z}} & (8e) & \text{Cl III} \\
\mathbf{B}_{32} &= x_7 \mathbf{a}_1 - (y_7 - \frac{1}{2}) \mathbf{a}_2 - (z_7 - \frac{1}{2}) \mathbf{a}_3 = ax_7 \hat{\mathbf{x}} - b(y_7 - \frac{1}{2}) \hat{\mathbf{y}} - c(z_7 - \frac{1}{2}) \hat{\mathbf{z}} & (8e) & \text{Cl III} \\
\mathbf{B}_{33} &= -x_7 \mathbf{a}_1 - y_7 \mathbf{a}_2 - z_7 \mathbf{a}_3 = -ax_7 \hat{\mathbf{x}} - by_7 \hat{\mathbf{y}} - cz_7 \hat{\mathbf{z}} & (8e) & \text{Cl III} \\
\mathbf{B}_{34} &= (x_7 + \frac{1}{2}) \mathbf{a}_1 + y_7 \mathbf{a}_2 - z_7 \mathbf{a}_3 = a(x_7 + \frac{1}{2}) \hat{\mathbf{x}} + by_7 \hat{\mathbf{y}} - cz_7 \hat{\mathbf{z}} & (8e) & \text{Cl III} \\
\mathbf{B}_{35} &= (x_7 + \frac{1}{2}) \mathbf{a}_1 - (y_7 - \frac{1}{2}) \mathbf{a}_2 + (z_7 + \frac{1}{2}) \mathbf{a}_3 = a(x_7 + \frac{1}{2}) \hat{\mathbf{x}} - b(y_7 - \frac{1}{2}) \hat{\mathbf{y}} + c(z_7 + \frac{1}{2}) \hat{\mathbf{z}} & (8e) & \text{Cl III} \\
\mathbf{B}_{36} &= -x_7 \mathbf{a}_1 + (y_7 + \frac{1}{2}) \mathbf{a}_2 + (z_7 + \frac{1}{2}) \mathbf{a}_3 = -ax_7 \hat{\mathbf{x}} + b(y_7 + \frac{1}{2}) \hat{\mathbf{y}} + c(z_7 + \frac{1}{2}) \hat{\mathbf{z}} & (8e) & \text{Cl III} \\
\mathbf{B}_{37} &= x_8 \mathbf{a}_1 + y_8 \mathbf{a}_2 + z_8 \mathbf{a}_3 = ax_8 \hat{\mathbf{x}} + by_8 \hat{\mathbf{y}} + cz_8 \hat{\mathbf{z}} & (8e) & \text{Cl IV} \\
\mathbf{B}_{38} &= -(x_8 - \frac{1}{2}) \mathbf{a}_1 - y_8 \mathbf{a}_2 + z_8 \mathbf{a}_3 = -a(x_8 - \frac{1}{2}) \hat{\mathbf{x}} - by_8 \hat{\mathbf{y}} + cz_8 \hat{\mathbf{z}} & (8e) & \text{Cl IV} \\
\mathbf{B}_{39} &= -(x_8 - \frac{1}{2}) \mathbf{a}_1 + (y_8 + \frac{1}{2}) \mathbf{a}_2 - (z_8 - \frac{1}{2}) \mathbf{a}_3 = -a(x_8 - \frac{1}{2}) \hat{\mathbf{x}} + b(y_8 + \frac{1}{2}) \hat{\mathbf{y}} - c(z_8 - \frac{1}{2}) \hat{\mathbf{z}} & (8e) & \text{Cl IV} \\
\mathbf{B}_{40} &= x_8 \mathbf{a}_1 - (y_8 - \frac{1}{2}) \mathbf{a}_2 - (z_8 - \frac{1}{2}) \mathbf{a}_3 = ax_8 \hat{\mathbf{x}} - b(y_8 - \frac{1}{2}) \hat{\mathbf{y}} - c(z_8 - \frac{1}{2}) \hat{\mathbf{z}} & (8e) & \text{Cl IV} \\
\mathbf{B}_{41} &= -x_8 \mathbf{a}_1 - y_8 \mathbf{a}_2 - z_8 \mathbf{a}_3 = -ax_8 \hat{\mathbf{x}} - by_8 \hat{\mathbf{y}} - cz_8 \hat{\mathbf{z}} & (8e) & \text{Cl IV} \\
\mathbf{B}_{42} &= (x_8 + \frac{1}{2}) \mathbf{a}_1 + y_8 \mathbf{a}_2 - z_8 \mathbf{a}_3 = a(x_8 + \frac{1}{2}) \hat{\mathbf{x}} + by_8 \hat{\mathbf{y}} - cz_8 \hat{\mathbf{z}} & (8e) & \text{Cl IV} \\
\mathbf{B}_{43} &= (x_8 + \frac{1}{2}) \mathbf{a}_1 - (y_8 - \frac{1}{2}) \mathbf{a}_2 + (z_8 + \frac{1}{2}) \mathbf{a}_3 = a(x_8 + \frac{1}{2}) \hat{\mathbf{x}} - b(y_8 - \frac{1}{2}) \hat{\mathbf{y}} + c(z_8 + \frac{1}{2}) \hat{\mathbf{z}} & (8e) & \text{Cl IV} \\
\mathbf{B}_{44} &= -x_8 \mathbf{a}_1 + (y_8 + \frac{1}{2}) \mathbf{a}_2 + (z_8 + \frac{1}{2}) \mathbf{a}_3 = -ax_8 \hat{\mathbf{x}} + b(y_8 + \frac{1}{2}) \hat{\mathbf{y}} + c(z_8 + \frac{1}{2}) \hat{\mathbf{z}} & (8e) & \text{Cl IV} \\
\mathbf{B}_{45} &= x_9 \mathbf{a}_1 + y_9 \mathbf{a}_2 + z_9 \mathbf{a}_3 = ax_9 \hat{\mathbf{x}} + by_9 \hat{\mathbf{y}} + cz_9 \hat{\mathbf{z}} & (8e) & \text{Cl V} \\
\mathbf{B}_{46} &= -(x_9 - \frac{1}{2}) \mathbf{a}_1 - y_9 \mathbf{a}_2 + z_9 \mathbf{a}_3 = -a(x_9 - \frac{1}{2}) \hat{\mathbf{x}} - by_9 \hat{\mathbf{y}} + cz_9 \hat{\mathbf{z}} & (8e) & \text{Cl V} \\
\mathbf{B}_{47} &= -(x_9 - \frac{1}{2}) \mathbf{a}_1 + (y_9 + \frac{1}{2}) \mathbf{a}_2 - (z_9 - \frac{1}{2}) \mathbf{a}_3 = -a(x_9 - \frac{1}{2}) \hat{\mathbf{x}} + b(y_9 + \frac{1}{2}) \hat{\mathbf{y}} - c(z_9 - \frac{1}{2}) \hat{\mathbf{z}} & (8e) & \text{Cl V} \\
\mathbf{B}_{48} &= x_9 \mathbf{a}_1 - (y_9 - \frac{1}{2}) \mathbf{a}_2 - (z_9 - \frac{1}{2}) \mathbf{a}_3 = ax_9 \hat{\mathbf{x}} - b(y_9 - \frac{1}{2}) \hat{\mathbf{y}} - c(z_9 - \frac{1}{2}) \hat{\mathbf{z}} & (8e) & \text{Cl V} \\
\mathbf{B}_{49} &= -x_9 \mathbf{a}_1 - y_9 \mathbf{a}_2 - z_9 \mathbf{a}_3 = -ax_9 \hat{\mathbf{x}} - by_9 \hat{\mathbf{y}} - cz_9 \hat{\mathbf{z}} & (8e) & \text{Cl V} \\
\mathbf{B}_{50} &= (x_9 + \frac{1}{2}) \mathbf{a}_1 + y_9 \mathbf{a}_2 - z_9 \mathbf{a}_3 = a(x_9 + \frac{1}{2}) \hat{\mathbf{x}} + by_9 \hat{\mathbf{y}} - cz_9 \hat{\mathbf{z}} & (8e) & \text{Cl V} \\
\mathbf{B}_{51} &= (x_9 + \frac{1}{2}) \mathbf{a}_1 - (y_9 - \frac{1}{2}) \mathbf{a}_2 + (z_9 + \frac{1}{2}) \mathbf{a}_3 = a(x_9 + \frac{1}{2}) \hat{\mathbf{x}} - b(y_9 - \frac{1}{2}) \hat{\mathbf{y}} + c(z_9 + \frac{1}{2}) \hat{\mathbf{z}} & (8e) & \text{Cl V} \\
\mathbf{B}_{52} &= -x_9 \mathbf{a}_1 + (y_9 + \frac{1}{2}) \mathbf{a}_2 + (z_9 + \frac{1}{2}) \mathbf{a}_3 = -ax_9 \hat{\mathbf{x}} + b(y_9 + \frac{1}{2}) \hat{\mathbf{y}} + c(z_9 + \frac{1}{2}) \hat{\mathbf{z}} & (8e) & \text{Cl V} \\
\mathbf{B}_{53} &= x_{10} \mathbf{a}_1 + y_{10} \mathbf{a}_2 + z_{10} \mathbf{a}_3 = ax_{10} \hat{\mathbf{x}} + by_{10} \hat{\mathbf{y}} + cz_{10} \hat{\mathbf{z}} & (8e) & \text{H I} \\
\mathbf{B}_{54} &= -(x_{10} - \frac{1}{2}) \mathbf{a}_1 - y_{10} \mathbf{a}_2 + z_{10} \mathbf{a}_3 = -a(x_{10} - \frac{1}{2}) \hat{\mathbf{x}} - by_{10} \hat{\mathbf{y}} + cz_{10} \hat{\mathbf{z}} & (8e) & \text{H I} \\
\mathbf{B}_{55} &= -(x_{10} - \frac{1}{2}) \mathbf{a}_1 + (y_{10} + \frac{1}{2}) \mathbf{a}_2 - (z_{10} - \frac{1}{2}) \mathbf{a}_3 = -a(x_{10} - \frac{1}{2}) \hat{\mathbf{x}} + b(y_{10} + \frac{1}{2}) \hat{\mathbf{y}} - c(z_{10} - \frac{1}{2}) \hat{\mathbf{z}} & (8e) & \text{H I}
\end{aligned}$$

















$$\begin{aligned}
\mathbf{B}_{266} &= \left(x_{36} + \frac{1}{2}\right) \mathbf{a}_1 + y_{36} \mathbf{a}_2 - z_{36} \mathbf{a}_3 &= & a \left(x_{36} + \frac{1}{2}\right) \hat{\mathbf{x}} + by_{36} \hat{\mathbf{y}} - cz_{36} \hat{\mathbf{z}} & (8e) & \text{O IX} \\
\mathbf{B}_{267} &= \left(x_{36} + \frac{1}{2}\right) \mathbf{a}_1 - \left(y_{36} - \frac{1}{2}\right) \mathbf{a}_2 + &= & a \left(x_{36} + \frac{1}{2}\right) \hat{\mathbf{x}} - b \left(y_{36} - \frac{1}{2}\right) \hat{\mathbf{y}} + & (8e) & \text{O IX} \\
&\quad \left(z_{36} + \frac{1}{2}\right) \mathbf{a}_3 && c \left(z_{36} + \frac{1}{2}\right) \hat{\mathbf{z}} \\
\mathbf{B}_{268} &= -x_{36} \mathbf{a}_1 + \left(y_{36} + \frac{1}{2}\right) \mathbf{a}_2 + &= & -ax_{36} \hat{\mathbf{x}} + b \left(y_{36} + \frac{1}{2}\right) \hat{\mathbf{y}} + c \left(z_{36} + \frac{1}{2}\right) \hat{\mathbf{z}} & (8e) & \text{O IX} \\
&\quad \left(z_{36} + \frac{1}{2}\right) \mathbf{a}_3 \\
\mathbf{B}_{269} &= x_{37} \mathbf{a}_1 + y_{37} \mathbf{a}_2 + z_{37} \mathbf{a}_3 &= & ax_{37} \hat{\mathbf{x}} + by_{37} \hat{\mathbf{y}} + cz_{37} \hat{\mathbf{z}} & (8e) & \text{O X} \\
\mathbf{B}_{270} &= -\left(x_{37} - \frac{1}{2}\right) \mathbf{a}_1 - y_{37} \mathbf{a}_2 + z_{37} \mathbf{a}_3 &= & -a \left(x_{37} - \frac{1}{2}\right) \hat{\mathbf{x}} - by_{37} \hat{\mathbf{y}} + cz_{37} \hat{\mathbf{z}} & (8e) & \text{O X} \\
\mathbf{B}_{271} &= -\left(x_{37} - \frac{1}{2}\right) \mathbf{a}_1 + \left(y_{37} + \frac{1}{2}\right) \mathbf{a}_2 - &= & -a \left(x_{37} - \frac{1}{2}\right) \hat{\mathbf{x}} + b \left(y_{37} + \frac{1}{2}\right) \hat{\mathbf{y}} - & (8e) & \text{O X} \\
&\quad \left(z_{37} - \frac{1}{2}\right) \mathbf{a}_3 && c \left(z_{37} - \frac{1}{2}\right) \hat{\mathbf{z}} \\
\mathbf{B}_{272} &= x_{37} \mathbf{a}_1 - \left(y_{37} - \frac{1}{2}\right) \mathbf{a}_2 - &= & ax_{37} \hat{\mathbf{x}} - b \left(y_{37} - \frac{1}{2}\right) \hat{\mathbf{y}} - c \left(z_{37} - \frac{1}{2}\right) \hat{\mathbf{z}} & (8e) & \text{O X} \\
&\quad \left(z_{37} - \frac{1}{2}\right) \mathbf{a}_3 \\
\mathbf{B}_{273} &= -x_{37} \mathbf{a}_1 - y_{37} \mathbf{a}_2 - z_{37} \mathbf{a}_3 &= & -ax_{37} \hat{\mathbf{x}} - by_{37} \hat{\mathbf{y}} - cz_{37} \hat{\mathbf{z}} & (8e) & \text{O X} \\
\mathbf{B}_{274} &= \left(x_{37} + \frac{1}{2}\right) \mathbf{a}_1 + y_{37} \mathbf{a}_2 - z_{37} \mathbf{a}_3 &= & a \left(x_{37} + \frac{1}{2}\right) \hat{\mathbf{x}} + by_{37} \hat{\mathbf{y}} - cz_{37} \hat{\mathbf{z}} & (8e) & \text{O X} \\
\mathbf{B}_{275} &= \left(x_{37} + \frac{1}{2}\right) \mathbf{a}_1 - \left(y_{37} - \frac{1}{2}\right) \mathbf{a}_2 + &= & a \left(x_{37} + \frac{1}{2}\right) \hat{\mathbf{x}} - b \left(y_{37} - \frac{1}{2}\right) \hat{\mathbf{y}} + & (8e) & \text{O X} \\
&\quad \left(z_{37} + \frac{1}{2}\right) \mathbf{a}_3 && c \left(z_{37} + \frac{1}{2}\right) \hat{\mathbf{z}} \\
\mathbf{B}_{276} &= -x_{37} \mathbf{a}_1 + \left(y_{37} + \frac{1}{2}\right) \mathbf{a}_2 + &= & -ax_{37} \hat{\mathbf{x}} + b \left(y_{37} + \frac{1}{2}\right) \hat{\mathbf{y}} + c \left(z_{37} + \frac{1}{2}\right) \hat{\mathbf{z}} & (8e) & \text{O X} \\
&\quad \left(z_{37} + \frac{1}{2}\right) \mathbf{a}_3
\end{aligned}$$

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