

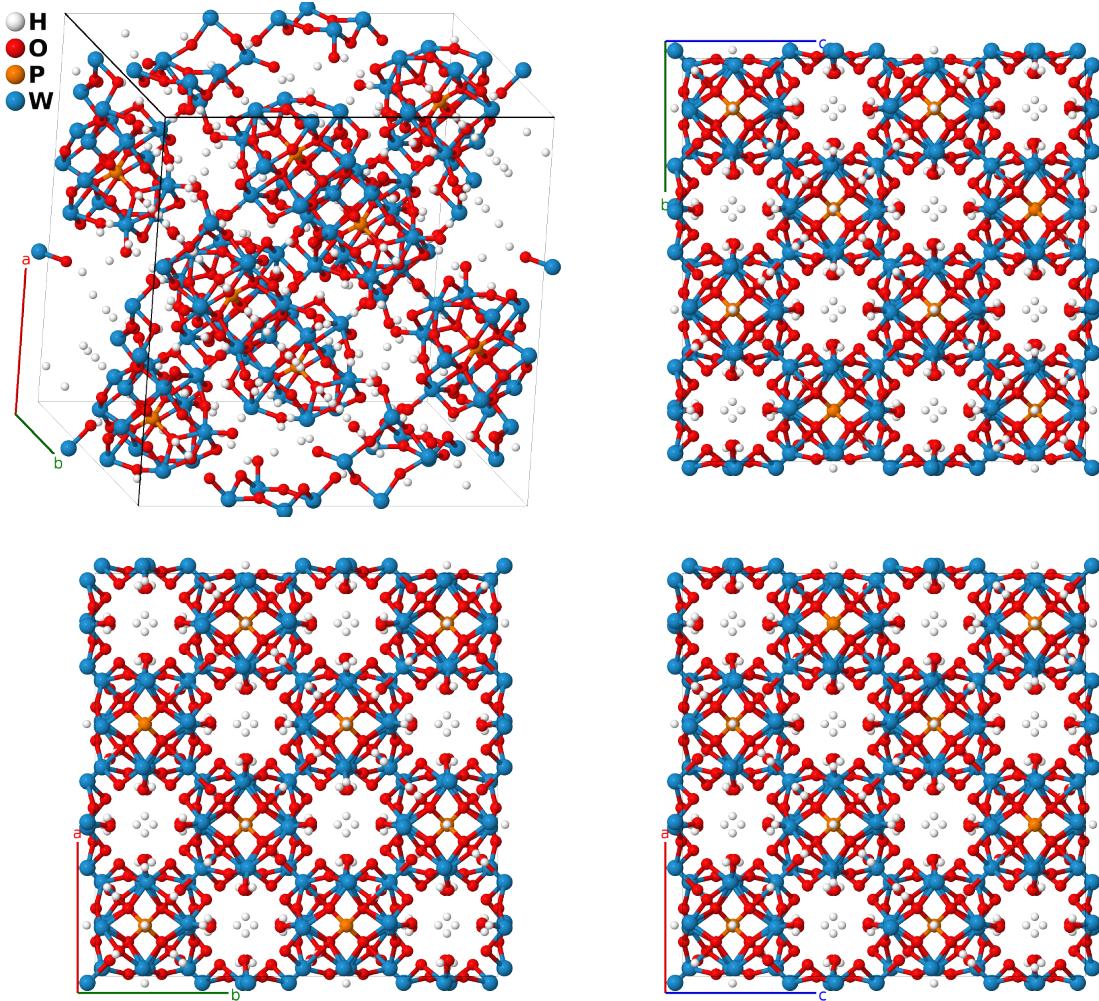
$\text{H}_3\text{PW}_{12}\text{O}_{40} \cdot 29\text{H}_2\text{O}$ ($H4_{21}$) Structure: A29B40CD12_cF656_227_ae2fg_e3g_b_g-001

This structure originally had the label A29B40CD12_cF656_227_ae2fg_e3g_b_g. Calls to that address will be redirected here.

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<https://aflow.org/p/3VYY>

https://aflow.org/p/A29B40CD12_cF656_227_ae2fg_e3g_b_g-001



Prototype	$\text{H}_3(\text{H}_2\text{O})_{29}\text{O}_{40}\text{PW}_{12}$
AFLOW prototype label	A29B40CD12_cF656_227_ae2fg_e3g_b_g-001
Strukturbericht designation	$H4_{21}$
Mineral name	29-phosphotungstic acid (PWA-29)
ICSD	36274
Pearson symbol	cF656
Space group number	227

Space group symbol $Fd\bar{3}m$

AFLW prototype command `aflow --proto=A29B40CD12_cF656_227_ae2fg_e3g_b_g-001
--params=a, x3, x4, x5, x6, x7, z7, x8, z8, x9, z9, x10, z10, x11, z11`

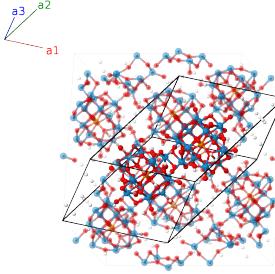
Other compounds with this structure



- This compound is often colloquially called “PWA-29.” On heating some water molecules will disassociate, leaving $H_3PW_{12}O_{40} \cdot 6H_2O$, $H_3PW_{12}O_{40} \cdot 5H_2O$ ($H4_{16}$), or $H_3PW_{12}O_{40} \cdot 3H_2O$.
- The three hydrogen atoms not formally associated with the water molecules are not located. Presumably they join with some water molecules to form form H_3O^+ ions.
- Even the exact number and position of the water molecules is uncertain. (Clark, 1976), studying the related compound $H_3PMo_{12}O_{40} \cdot 30H_2O$, states that the composition is approximately $30H_2O$ and that “only six of the water molecules occupy ordered sites.”

Face-centered Cubic primitive vectors

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



Basis vectors

	Lattice coordinates		Cartesian coordinates	Wyckoff position	Atom type
\mathbf{B}_1	$\frac{1}{8}\mathbf{a}_1 + \frac{1}{8}\mathbf{a}_2 + \frac{1}{8}\mathbf{a}_3$	=	$\frac{1}{8}a\hat{\mathbf{x}} + \frac{1}{8}a\hat{\mathbf{y}} + \frac{1}{8}a\hat{\mathbf{z}}$	(8a)	H I
\mathbf{B}_2	$\frac{7}{8}\mathbf{a}_1 + \frac{7}{8}\mathbf{a}_2 + \frac{7}{8}\mathbf{a}_3$	=	$\frac{7}{8}a\hat{\mathbf{x}} + \frac{7}{8}a\hat{\mathbf{y}} + \frac{7}{8}a\hat{\mathbf{z}}$	(8a)	H I
\mathbf{B}_3	$\frac{3}{8}\mathbf{a}_1 + \frac{3}{8}\mathbf{a}_2 + \frac{3}{8}\mathbf{a}_3$	=	$\frac{3}{8}a\hat{\mathbf{x}} + \frac{3}{8}a\hat{\mathbf{y}} + \frac{3}{8}a\hat{\mathbf{z}}$	(8b)	P I
\mathbf{B}_4	$\frac{5}{8}\mathbf{a}_1 + \frac{5}{8}\mathbf{a}_2 + \frac{5}{8}\mathbf{a}_3$	=	$\frac{5}{8}a\hat{\mathbf{x}} + \frac{5}{8}a\hat{\mathbf{y}} + \frac{5}{8}a\hat{\mathbf{z}}$	(8b)	P I
\mathbf{B}_5	$x_3\mathbf{a}_1 + x_3\mathbf{a}_2 + x_3\mathbf{a}_3$	=	$ax_3\hat{\mathbf{x}} + ax_3\hat{\mathbf{y}} + ax_3\hat{\mathbf{z}}$	(32e)	H II
\mathbf{B}_6	$x_3\mathbf{a}_1 + x_3\mathbf{a}_2 - (3x_3 - \frac{1}{2})\mathbf{a}_3$	=	$-a(x_3 - \frac{1}{4})\hat{\mathbf{x}} - a(x_3 - \frac{1}{4})\hat{\mathbf{y}} + ax_3\hat{\mathbf{z}}$	(32e)	H II
\mathbf{B}_7	$x_3\mathbf{a}_1 - (3x_3 - \frac{1}{2})\mathbf{a}_2 + x_3\mathbf{a}_3$	=	$-a(x_3 - \frac{1}{4})\hat{\mathbf{x}} + ax_3\hat{\mathbf{y}} - a(x_3 - \frac{1}{4})\hat{\mathbf{z}}$	(32e)	H II
\mathbf{B}_8	$-(3x_3 - \frac{1}{2})\mathbf{a}_1 + x_3\mathbf{a}_2 + x_3\mathbf{a}_3$	=	$ax_3\hat{\mathbf{x}} - a(x_3 - \frac{1}{4})\hat{\mathbf{y}} - a(x_3 - \frac{1}{4})\hat{\mathbf{z}}$	(32e)	H II
\mathbf{B}_9	$-x_3\mathbf{a}_1 - x_3\mathbf{a}_2 + (3x_3 + \frac{1}{2})\mathbf{a}_3$	=	$a(x_3 + \frac{1}{4})\hat{\mathbf{x}} + a(x_3 + \frac{1}{4})\hat{\mathbf{y}} - ax_3\hat{\mathbf{z}}$	(32e)	H II
\mathbf{B}_{10}	$-x_3\mathbf{a}_1 - x_3\mathbf{a}_2 - x_3\mathbf{a}_3$	=	$-ax_3\hat{\mathbf{x}} - ax_3\hat{\mathbf{y}} - ax_3\hat{\mathbf{z}}$	(32e)	H II
\mathbf{B}_{11}	$-x_3\mathbf{a}_1 + (3x_3 + \frac{1}{2})\mathbf{a}_2 - x_3\mathbf{a}_3$	=	$a(x_3 + \frac{1}{4})\hat{\mathbf{x}} - ax_3\hat{\mathbf{y}} + a(x_3 + \frac{1}{4})\hat{\mathbf{z}}$	(32e)	H II
\mathbf{B}_{12}	$(3x_3 + \frac{1}{2})\mathbf{a}_1 - x_3\mathbf{a}_2 - x_3\mathbf{a}_3$	=	$-ax_3\hat{\mathbf{x}} + a(x_3 + \frac{1}{4})\hat{\mathbf{y}} + a(x_3 + \frac{1}{4})\hat{\mathbf{z}}$	(32e)	H II
\mathbf{B}_{13}	$x_4\mathbf{a}_1 + x_4\mathbf{a}_2 + x_4\mathbf{a}_3$	=	$ax_4\hat{\mathbf{x}} + ax_4\hat{\mathbf{y}} + ax_4\hat{\mathbf{z}}$	(32e)	O I
\mathbf{B}_{14}	$x_4\mathbf{a}_1 + x_4\mathbf{a}_2 - (3x_4 - \frac{1}{2})\mathbf{a}_3$	=	$-a(x_4 - \frac{1}{4})\hat{\mathbf{x}} - a(x_4 - \frac{1}{4})\hat{\mathbf{y}} + ax_4\hat{\mathbf{z}}$	(32e)	O I
\mathbf{B}_{15}	$x_4\mathbf{a}_1 - (3x_4 - \frac{1}{2})\mathbf{a}_2 + x_4\mathbf{a}_3$	=	$-a(x_4 - \frac{1}{4})\hat{\mathbf{x}} + ax_4\hat{\mathbf{y}} - a(x_4 - \frac{1}{4})\hat{\mathbf{z}}$	(32e)	O I

B_{16}	$=$	$-(3x_4 - \frac{1}{2}) \mathbf{a}_1 + x_4 \mathbf{a}_2 + x_4 \mathbf{a}_3$	$=$	$ax_4 \hat{\mathbf{x}} - a(x_4 - \frac{1}{4}) \hat{\mathbf{y}} - a(x_4 - \frac{1}{4}) \hat{\mathbf{z}}$	(32e)	O I
B_{17}	$=$	$-x_4 \mathbf{a}_1 - x_4 \mathbf{a}_2 + (3x_4 + \frac{1}{2}) \mathbf{a}_3$	$=$	$a(x_4 + \frac{1}{4}) \hat{\mathbf{x}} + a(x_4 + \frac{1}{4}) \hat{\mathbf{y}} - ax_4 \hat{\mathbf{z}}$	(32e)	O I
B_{18}	$=$	$-x_4 \mathbf{a}_1 - x_4 \mathbf{a}_2 - x_4 \mathbf{a}_3$	$=$	$-ax_4 \hat{\mathbf{x}} - ax_4 \hat{\mathbf{y}} - ax_4 \hat{\mathbf{z}}$	(32e)	O I
B_{19}	$=$	$-x_4 \mathbf{a}_1 + (3x_4 + \frac{1}{2}) \mathbf{a}_2 - x_4 \mathbf{a}_3$	$=$	$a(x_4 + \frac{1}{4}) \hat{\mathbf{x}} - ax_4 \hat{\mathbf{y}} + a(x_4 + \frac{1}{4}) \hat{\mathbf{z}}$	(32e)	O I
B_{20}	$=$	$(3x_4 + \frac{1}{2}) \mathbf{a}_1 - x_4 \mathbf{a}_2 - x_4 \mathbf{a}_3$	$=$	$-ax_4 \hat{\mathbf{x}} + a(x_4 + \frac{1}{4}) \hat{\mathbf{y}} + a(x_4 + \frac{1}{4}) \hat{\mathbf{z}}$	(32e)	O I
B_{21}	$=$	$-(x_5 - \frac{1}{4}) \mathbf{a}_1 + x_5 \mathbf{a}_2 + x_5 \mathbf{a}_3$	$=$	$ax_5 \hat{\mathbf{x}} + \frac{1}{8}a \hat{\mathbf{y}} + \frac{1}{8}a \hat{\mathbf{z}}$	(48f)	H III
B_{22}	$=$	$x_5 \mathbf{a}_1 - (x_5 - \frac{1}{4}) \mathbf{a}_2 - (x_5 - \frac{1}{4}) \mathbf{a}_3$	$=$	$-a(x_5 - \frac{1}{4}) \hat{\mathbf{x}} + \frac{1}{8}a \hat{\mathbf{y}} + \frac{1}{8}a \hat{\mathbf{z}}$	(48f)	H III
B_{23}	$=$	$x_5 \mathbf{a}_1 - (x_5 - \frac{1}{4}) \mathbf{a}_2 + x_5 \mathbf{a}_3$	$=$	$\frac{1}{8}a \hat{\mathbf{x}} + ax_5 \hat{\mathbf{y}} + \frac{1}{8}a \hat{\mathbf{z}}$	(48f)	H III
B_{24}	$=$	$-(x_5 - \frac{1}{4}) \mathbf{a}_1 + x_5 \mathbf{a}_2 - (x_5 - \frac{1}{4}) \mathbf{a}_3$	$=$	$\frac{1}{8}a \hat{\mathbf{x}} - a(x_5 - \frac{1}{4}) \hat{\mathbf{y}} + \frac{1}{8}a \hat{\mathbf{z}}$	(48f)	H III
B_{25}	$=$	$x_5 \mathbf{a}_1 + x_5 \mathbf{a}_2 - (x_5 - \frac{1}{4}) \mathbf{a}_3$	$=$	$\frac{1}{8}a \hat{\mathbf{x}} + \frac{1}{8}a \hat{\mathbf{y}} + ax_5 \hat{\mathbf{z}}$	(48f)	H III
B_{26}	$=$	$-(x_5 - \frac{1}{4}) \mathbf{a}_1 - (x_5 - \frac{1}{4}) \mathbf{a}_2 + x_5 \mathbf{a}_3$	$=$	$\frac{1}{8}a \hat{\mathbf{x}} + \frac{1}{8}a \hat{\mathbf{y}} - a(x_5 - \frac{1}{4}) \hat{\mathbf{z}}$	(48f)	H III
B_{27}	$=$	$(x_5 + \frac{3}{4}) \mathbf{a}_1 - x_5 \mathbf{a}_2 + (x_5 + \frac{3}{4}) \mathbf{a}_3$	$=$	$\frac{3}{8}a \hat{\mathbf{x}} + a(x_5 + \frac{3}{4}) \hat{\mathbf{y}} + \frac{3}{8}a \hat{\mathbf{z}}$	(48f)	H III
B_{28}	$=$	$-x_5 \mathbf{a}_1 + (x_5 + \frac{3}{4}) \mathbf{a}_2 - x_5 \mathbf{a}_3$	$=$	$\frac{3}{8}a \hat{\mathbf{x}} - ax_5 \hat{\mathbf{y}} + \frac{3}{8}a \hat{\mathbf{z}}$	(48f)	H III
B_{29}	$=$	$-x_5 \mathbf{a}_1 + (x_5 + \frac{3}{4}) \mathbf{a}_2 + (x_5 + \frac{3}{4}) \mathbf{a}_3$	$=$	$a(x_5 + \frac{3}{4}) \hat{\mathbf{x}} + \frac{3}{8}a \hat{\mathbf{y}} + \frac{3}{8}a \hat{\mathbf{z}}$	(48f)	H III
B_{30}	$=$	$(x_5 + \frac{3}{4}) \mathbf{a}_1 - x_5 \mathbf{a}_2 - x_5 \mathbf{a}_3$	$=$	$-ax_5 \hat{\mathbf{x}} + \frac{3}{8}a \hat{\mathbf{y}} + \frac{3}{8}a \hat{\mathbf{z}}$	(48f)	H III
B_{31}	$=$	$-x_5 \mathbf{a}_1 - x_5 \mathbf{a}_2 + (x_5 + \frac{3}{4}) \mathbf{a}_3$	$=$	$\frac{3}{8}a \hat{\mathbf{x}} + \frac{3}{8}a \hat{\mathbf{y}} - ax_5 \hat{\mathbf{z}}$	(48f)	H III
B_{32}	$=$	$(x_5 + \frac{3}{4}) \mathbf{a}_1 + (x_5 + \frac{3}{4}) \mathbf{a}_2 - x_5 \mathbf{a}_3$	$=$	$\frac{3}{8}a \hat{\mathbf{x}} + \frac{3}{8}a \hat{\mathbf{y}} + a(x_5 + \frac{3}{4}) \hat{\mathbf{z}}$	(48f)	H III
B_{33}	$=$	$-(x_6 - \frac{1}{4}) \mathbf{a}_1 + x_6 \mathbf{a}_2 + x_6 \mathbf{a}_3$	$=$	$ax_6 \hat{\mathbf{x}} + \frac{1}{8}a \hat{\mathbf{y}} + \frac{1}{8}a \hat{\mathbf{z}}$	(48f)	H IV
B_{34}	$=$	$x_6 \mathbf{a}_1 - (x_6 - \frac{1}{4}) \mathbf{a}_2 - (x_6 - \frac{1}{4}) \mathbf{a}_3$	$=$	$-a(x_6 - \frac{1}{4}) \hat{\mathbf{x}} + \frac{1}{8}a \hat{\mathbf{y}} + \frac{1}{8}a \hat{\mathbf{z}}$	(48f)	H IV
B_{35}	$=$	$x_6 \mathbf{a}_1 - (x_6 - \frac{1}{4}) \mathbf{a}_2 + x_6 \mathbf{a}_3$	$=$	$\frac{1}{8}a \hat{\mathbf{x}} + ax_6 \hat{\mathbf{y}} + \frac{1}{8}a \hat{\mathbf{z}}$	(48f)	H IV
B_{36}	$=$	$-(x_6 - \frac{1}{4}) \mathbf{a}_1 + x_6 \mathbf{a}_2 - (x_6 - \frac{1}{4}) \mathbf{a}_3$	$=$	$\frac{1}{8}a \hat{\mathbf{x}} - a(x_6 - \frac{1}{4}) \hat{\mathbf{y}} + \frac{1}{8}a \hat{\mathbf{z}}$	(48f)	H IV
B_{37}	$=$	$x_6 \mathbf{a}_1 + x_6 \mathbf{a}_2 - (x_6 - \frac{1}{4}) \mathbf{a}_3$	$=$	$\frac{1}{8}a \hat{\mathbf{x}} + \frac{1}{8}a \hat{\mathbf{y}} + ax_6 \hat{\mathbf{z}}$	(48f)	H IV
B_{38}	$=$	$-(x_6 - \frac{1}{4}) \mathbf{a}_1 - (x_6 - \frac{1}{4}) \mathbf{a}_2 + x_6 \mathbf{a}_3$	$=$	$\frac{1}{8}a \hat{\mathbf{x}} + \frac{1}{8}a \hat{\mathbf{y}} - a(x_6 - \frac{1}{4}) \hat{\mathbf{z}}$	(48f)	H IV
B_{39}	$=$	$(x_6 + \frac{3}{4}) \mathbf{a}_1 - x_6 \mathbf{a}_2 + (x_6 + \frac{3}{4}) \mathbf{a}_3$	$=$	$\frac{3}{8}a \hat{\mathbf{x}} + a(x_6 + \frac{3}{4}) \hat{\mathbf{y}} + \frac{3}{8}a \hat{\mathbf{z}}$	(48f)	H IV
B_{40}	$=$	$-x_6 \mathbf{a}_1 + (x_6 + \frac{3}{4}) \mathbf{a}_2 - x_6 \mathbf{a}_3$	$=$	$\frac{3}{8}a \hat{\mathbf{x}} - ax_6 \hat{\mathbf{y}} + \frac{3}{8}a \hat{\mathbf{z}}$	(48f)	H IV
B_{41}	$=$	$-x_6 \mathbf{a}_1 + (x_6 + \frac{3}{4}) \mathbf{a}_2 + (x_6 + \frac{3}{4}) \mathbf{a}_3$	$=$	$a(x_6 + \frac{3}{4}) \hat{\mathbf{x}} + \frac{3}{8}a \hat{\mathbf{y}} + \frac{3}{8}a \hat{\mathbf{z}}$	(48f)	H IV
B_{42}	$=$	$(x_6 + \frac{3}{4}) \mathbf{a}_1 - x_6 \mathbf{a}_2 - x_6 \mathbf{a}_3$	$=$	$-ax_6 \hat{\mathbf{x}} + \frac{3}{8}a \hat{\mathbf{y}} + \frac{3}{8}a \hat{\mathbf{z}}$	(48f)	H IV
B_{43}	$=$	$-x_6 \mathbf{a}_1 - x_6 \mathbf{a}_2 + (x_6 + \frac{3}{4}) \mathbf{a}_3$	$=$	$\frac{3}{8}a \hat{\mathbf{x}} + \frac{3}{8}a \hat{\mathbf{y}} - ax_6 \hat{\mathbf{z}}$	(48f)	H IV
B_{44}	$=$	$(x_6 + \frac{3}{4}) \mathbf{a}_1 + (x_6 + \frac{3}{4}) \mathbf{a}_2 - x_6 \mathbf{a}_3$	$=$	$\frac{3}{8}a \hat{\mathbf{x}} + \frac{3}{8}a \hat{\mathbf{y}} + a(x_6 + \frac{3}{4}) \hat{\mathbf{z}}$	(48f)	H IV
B_{45}	$=$	$z_7 \mathbf{a}_1 + z_7 \mathbf{a}_2 + (2x_7 - z_7) \mathbf{a}_3$	$=$	$ax_7 \hat{\mathbf{x}} + ax_7 \hat{\mathbf{y}} + az_7 \hat{\mathbf{z}}$	(96g)	H V
B_{46}	$=$	$z_7 \mathbf{a}_1 + z_7 \mathbf{a}_2 - (2x_7 + z_7 - \frac{1}{2}) \mathbf{a}_3$	$=$	$-a(x_7 - \frac{1}{4}) \hat{\mathbf{x}} - a(x_7 - \frac{1}{4}) \hat{\mathbf{y}} + az_7 \hat{\mathbf{z}}$	(96g)	H V
B_{47}	$=$	$(2x_7 - z_7) \mathbf{a}_1 - (2x_7 + z_7 - \frac{1}{2}) \mathbf{a}_2 + z_7 \mathbf{a}_3$	$=$	$-a(x_7 - \frac{1}{4}) \hat{\mathbf{x}} + ax_7 \hat{\mathbf{y}} - a(z_7 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	H V
B_{48}	$=$	$-(2x_7 + z_7 - \frac{1}{2}) \mathbf{a}_1 + (2x_7 - z_7) \mathbf{a}_2 + z_7 \mathbf{a}_3$	$=$	$ax_7 \hat{\mathbf{x}} - a(x_7 - \frac{1}{4}) \hat{\mathbf{y}} - a(z_7 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	H V
B_{49}	$=$	$(2x_7 - z_7) \mathbf{a}_1 + z_7 \mathbf{a}_2 + z_7 \mathbf{a}_3$	$=$	$az_7 \hat{\mathbf{x}} + ax_7 \hat{\mathbf{y}} + ax_7 \hat{\mathbf{z}}$	(96g)	H V
B_{50}	$=$	$-(2x_7 + z_7 - \frac{1}{2}) \mathbf{a}_1 + z_7 \mathbf{a}_2 + z_7 \mathbf{a}_3$	$=$	$az_7 \hat{\mathbf{x}} - a(x_7 - \frac{1}{4}) \hat{\mathbf{y}} - a(x_7 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	H V

B₅₁	$= z_7 \mathbf{a}_1 + (2x_7 - z_7) \mathbf{a}_2 - (2x_7 + z_7 - \frac{1}{2}) \mathbf{a}_3$	$= -a(z_7 - \frac{1}{4}) \hat{\mathbf{x}} - a(x_7 - \frac{1}{4}) \hat{\mathbf{y}} + ax_7 \hat{\mathbf{z}}$	(96g)	H V
B₅₂	$= z_7 \mathbf{a}_1 - (2x_7 + z_7 - \frac{1}{2}) \mathbf{a}_2 + (2x_7 - z_7) \mathbf{a}_3$	$= -a(z_7 - \frac{1}{4}) \hat{\mathbf{x}} + ax_7 \hat{\mathbf{y}} - a(x_7 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	H V
B₅₃	$= z_7 \mathbf{a}_1 + (2x_7 - z_7) \mathbf{a}_2 + z_7 \mathbf{a}_3$	$= ax_7 \hat{\mathbf{x}} + az_7 \hat{\mathbf{y}} + ax_7 \hat{\mathbf{z}}$	(96g)	H V
B₅₄	$= z_7 \mathbf{a}_1 - (2x_7 + z_7 - \frac{1}{2}) \mathbf{a}_2 + z_7 \mathbf{a}_3$	$= -a(x_7 - \frac{1}{4}) \hat{\mathbf{x}} + az_7 \hat{\mathbf{y}} - a(x_7 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	H V
B₅₅	$= -(2x_7 + z_7 - \frac{1}{2}) \mathbf{a}_1 + z_7 \mathbf{a}_2 + (2x_7 - z_7) \mathbf{a}_3$	$= ax_7 \hat{\mathbf{x}} - a(z_7 - \frac{1}{4}) \hat{\mathbf{y}} - a(x_7 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	H V
B₅₆	$= (2x_7 - z_7) \mathbf{a}_1 + z_7 \mathbf{a}_2 - (2x_7 + z_7 - \frac{1}{2}) \mathbf{a}_3$	$= -a(x_7 - \frac{1}{4}) \hat{\mathbf{x}} - a(z_7 - \frac{1}{4}) \hat{\mathbf{y}} + ax_7 \hat{\mathbf{z}}$	(96g)	H V
B₅₇	$= -z_7 \mathbf{a}_1 - z_7 \mathbf{a}_2 + (2x_7 + z_7 + \frac{1}{2}) \mathbf{a}_3$	$= a(x_7 + \frac{1}{4}) \hat{\mathbf{x}} + a(x_7 + \frac{1}{4}) \hat{\mathbf{y}} - az_7 \hat{\mathbf{z}}$	(96g)	H V
B₅₈	$= -z_7 \mathbf{a}_1 - z_7 \mathbf{a}_2 - (2x_7 - z_7) \mathbf{a}_3$	$= -ax_7 \hat{\mathbf{x}} - ax_7 \hat{\mathbf{y}} - az_7 \hat{\mathbf{z}}$	(96g)	H V
B₅₉	$= -(2x_7 - z_7) \mathbf{a}_1 + (2x_7 + z_7 + \frac{1}{2}) \mathbf{a}_2 - z_7 \mathbf{a}_3$	$= a(x_7 + \frac{1}{4}) \hat{\mathbf{x}} - ax_7 \hat{\mathbf{y}} + a(z_7 + \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	H V
B₆₀	$= (2x_7 + z_7 + \frac{1}{2}) \mathbf{a}_1 - (2x_7 - z_7) \mathbf{a}_2 - z_7 \mathbf{a}_3$	$= -ax_7 \hat{\mathbf{x}} + a(x_7 + \frac{1}{4}) \hat{\mathbf{y}} + a(z_7 + \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	H V
B₆₁	$= -(2x_7 - z_7) \mathbf{a}_1 - z_7 \mathbf{a}_2 + (2x_7 + z_7 + \frac{1}{2}) \mathbf{a}_3$	$= a(x_7 + \frac{1}{4}) \hat{\mathbf{x}} + a(z_7 + \frac{1}{4}) \hat{\mathbf{y}} - ax_7 \hat{\mathbf{z}}$	(96g)	H V
B₆₂	$= (2x_7 + z_7 + \frac{1}{2}) \mathbf{a}_1 - z_7 \mathbf{a}_2 - (2x_7 - z_7) \mathbf{a}_3$	$= -ax_7 \hat{\mathbf{x}} + a(z_7 + \frac{1}{4}) \hat{\mathbf{y}} + a(x_7 + \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	H V
B₆₃	$= -z_7 \mathbf{a}_1 - (2x_7 - z_7) \mathbf{a}_2 - z_7 \mathbf{a}_3$	$= -ax_7 \hat{\mathbf{x}} - az_7 \hat{\mathbf{y}} - ax_7 \hat{\mathbf{z}}$	(96g)	H V
B₆₄	$= -z_7 \mathbf{a}_1 + (2x_7 + z_7 + \frac{1}{2}) \mathbf{a}_2 - z_7 \mathbf{a}_3$	$= a(x_7 + \frac{1}{4}) \hat{\mathbf{x}} - az_7 \hat{\mathbf{y}} + a(x_7 + \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	H V
B₆₅	$= -z_7 \mathbf{a}_1 - (2x_7 - z_7) \mathbf{a}_2 + (2x_7 + z_7 + \frac{1}{2}) \mathbf{a}_3$	$= a(z_7 + \frac{1}{4}) \hat{\mathbf{x}} + a(x_7 + \frac{1}{4}) \hat{\mathbf{y}} - ax_7 \hat{\mathbf{z}}$	(96g)	H V
B₆₆	$= -z_7 \mathbf{a}_1 + (2x_7 + z_7 + \frac{1}{2}) \mathbf{a}_2 - (2x_7 - z_7) \mathbf{a}_3$	$= a(z_7 + \frac{1}{4}) \hat{\mathbf{x}} - ax_7 \hat{\mathbf{y}} + a(x_7 + \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	H V
B₆₇	$= (2x_7 + z_7 + \frac{1}{2}) \mathbf{a}_1 - z_7 \mathbf{a}_2 - z_7 \mathbf{a}_3$	$= -az_7 \hat{\mathbf{x}} + a(x_7 + \frac{1}{4}) \hat{\mathbf{y}} + a(x_7 + \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	H V
B₆₈	$= -(2x_7 - z_7) \mathbf{a}_1 - z_7 \mathbf{a}_2 - z_7 \mathbf{a}_3$	$= -az_7 \hat{\mathbf{x}} - ax_7 \hat{\mathbf{y}} - ax_7 \hat{\mathbf{z}}$	(96g)	H V
B₆₉	$= z_8 \mathbf{a}_1 + z_8 \mathbf{a}_2 + (2x_8 - z_8) \mathbf{a}_3$	$= ax_8 \hat{\mathbf{x}} + ax_8 \hat{\mathbf{y}} + az_8 \hat{\mathbf{z}}$	(96g)	O II
B₇₀	$= z_8 \mathbf{a}_1 + z_8 \mathbf{a}_2 - (2x_8 + z_8 - \frac{1}{2}) \mathbf{a}_3$	$= -a(x_8 - \frac{1}{4}) \hat{\mathbf{x}} - a(x_8 - \frac{1}{4}) \hat{\mathbf{y}} + az_8 \hat{\mathbf{z}}$	(96g)	O II
B₇₁	$= (2x_8 - z_8) \mathbf{a}_1 - (2x_8 + z_8 - \frac{1}{2}) \mathbf{a}_2 + z_8 \mathbf{a}_3$	$= -a(x_8 - \frac{1}{4}) \hat{\mathbf{x}} + ax_8 \hat{\mathbf{y}} - a(z_8 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O II
B₇₂	$= -(2x_8 + z_8 - \frac{1}{2}) \mathbf{a}_1 + (2x_8 - z_8) \mathbf{a}_2 + z_8 \mathbf{a}_3$	$= ax_8 \hat{\mathbf{x}} - a(x_8 - \frac{1}{4}) \hat{\mathbf{y}} - a(z_8 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O II
B₇₃	$= (2x_8 - z_8) \mathbf{a}_1 + z_8 \mathbf{a}_2 + z_8 \mathbf{a}_3$	$= az_8 \hat{\mathbf{x}} + ax_8 \hat{\mathbf{y}} + ax_8 \hat{\mathbf{z}}$	(96g)	O II
B₇₄	$= -(2x_8 + z_8 - \frac{1}{2}) \mathbf{a}_1 + z_8 \mathbf{a}_2 + z_8 \mathbf{a}_3$	$= az_8 \hat{\mathbf{x}} - a(x_8 - \frac{1}{4}) \hat{\mathbf{y}} - a(x_8 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O II
B₇₅	$= z_8 \mathbf{a}_1 + (2x_8 - z_8) \mathbf{a}_2 - (2x_8 + z_8 - \frac{1}{2}) \mathbf{a}_3$	$= -a(z_8 - \frac{1}{4}) \hat{\mathbf{x}} - a(x_8 - \frac{1}{4}) \hat{\mathbf{y}} + ax_8 \hat{\mathbf{z}}$	(96g)	O II
B₇₆	$= z_8 \mathbf{a}_1 - (2x_8 + z_8 - \frac{1}{2}) \mathbf{a}_2 + (2x_8 - z_8) \mathbf{a}_3$	$= -a(z_8 - \frac{1}{4}) \hat{\mathbf{x}} + ax_8 \hat{\mathbf{y}} - a(x_8 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O II
B₇₇	$= z_8 \mathbf{a}_1 + (2x_8 - z_8) \mathbf{a}_2 + z_8 \mathbf{a}_3$	$= ax_8 \hat{\mathbf{x}} + az_8 \hat{\mathbf{y}} + ax_8 \hat{\mathbf{z}}$	(96g)	O II
B₇₈	$= z_8 \mathbf{a}_1 - (2x_8 + z_8 - \frac{1}{2}) \mathbf{a}_2 + z_8 \mathbf{a}_3$	$= -a(x_8 - \frac{1}{4}) \hat{\mathbf{x}} + az_8 \hat{\mathbf{y}} - a(x_8 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O II

B₇₉	$= - (2x_8 + z_8 - \frac{1}{2}) \mathbf{a}_1 + z_8 \mathbf{a}_2 + (2x_8 - z_8) \mathbf{a}_3$	$= ax_8 \hat{\mathbf{x}} - a(z_8 - \frac{1}{4}) \hat{\mathbf{y}} - a(x_8 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O II
B₈₀	$= (2x_8 - z_8) \mathbf{a}_1 + z_8 \mathbf{a}_2 - (2x_8 + z_8 - \frac{1}{2}) \mathbf{a}_3$	$= -a(x_8 - \frac{1}{4}) \hat{\mathbf{x}} - a(z_8 - \frac{1}{4}) \hat{\mathbf{y}} + ax_8 \hat{\mathbf{z}}$	(96g)	O II
B₈₁	$= -z_8 \mathbf{a}_1 - z_8 \mathbf{a}_2 + (2x_8 + z_8 + \frac{1}{2}) \mathbf{a}_3$	$= a(x_8 + \frac{1}{4}) \hat{\mathbf{x}} + a(x_8 + \frac{1}{4}) \hat{\mathbf{y}} - az_8 \hat{\mathbf{z}}$	(96g)	O II
B₈₂	$= -z_8 \mathbf{a}_1 - z_8 \mathbf{a}_2 - (2x_8 - z_8) \mathbf{a}_3$	$= -ax_8 \hat{\mathbf{x}} - ax_8 \hat{\mathbf{y}} - az_8 \hat{\mathbf{z}}$	(96g)	O II
B₈₃	$= -(2x_8 - z_8) \mathbf{a}_1 + (2x_8 + z_8 + \frac{1}{2}) \mathbf{a}_2 - z_8 \mathbf{a}_3$	$= a(x_8 + \frac{1}{4}) \hat{\mathbf{x}} - ax_8 \hat{\mathbf{y}} + a(z_8 + \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O II
B₈₄	$= (2x_8 + z_8 + \frac{1}{2}) \mathbf{a}_1 - (2x_8 - z_8) \mathbf{a}_2 - z_8 \mathbf{a}_3$	$= -ax_8 \hat{\mathbf{x}} + a(x_8 + \frac{1}{4}) \hat{\mathbf{y}} + a(z_8 + \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O II
B₈₅	$= -(2x_8 - z_8) \mathbf{a}_1 - z_8 \mathbf{a}_2 + (2x_8 + z_8 + \frac{1}{2}) \mathbf{a}_3$	$= a(x_8 + \frac{1}{4}) \hat{\mathbf{x}} + a(z_8 + \frac{1}{4}) \hat{\mathbf{y}} - ax_8 \hat{\mathbf{z}}$	(96g)	O II
B₈₆	$= (2x_8 + z_8 + \frac{1}{2}) \mathbf{a}_1 - z_8 \mathbf{a}_2 - (2x_8 - z_8) \mathbf{a}_3$	$= -ax_8 \hat{\mathbf{x}} + a(z_8 + \frac{1}{4}) \hat{\mathbf{y}} + a(x_8 + \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O II
B₈₇	$= -z_8 \mathbf{a}_1 - (2x_8 - z_8) \mathbf{a}_2 - z_8 \mathbf{a}_3$	$= -ax_8 \hat{\mathbf{x}} - az_8 \hat{\mathbf{y}} - ax_8 \hat{\mathbf{z}}$	(96g)	O II
B₈₈	$= -z_8 \mathbf{a}_1 + (2x_8 + z_8 + \frac{1}{2}) \mathbf{a}_2 - z_8 \mathbf{a}_3$	$= a(x_8 + \frac{1}{4}) \hat{\mathbf{x}} - az_8 \hat{\mathbf{y}} + a(x_8 + \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O II
B₈₉	$= -z_8 \mathbf{a}_1 - (2x_8 - z_8) \mathbf{a}_2 + (2x_8 + z_8 + \frac{1}{2}) \mathbf{a}_3$	$= a(z_8 + \frac{1}{4}) \hat{\mathbf{x}} + a(x_8 + \frac{1}{4}) \hat{\mathbf{y}} - ax_8 \hat{\mathbf{z}}$	(96g)	O II
B₉₀	$= -z_8 \mathbf{a}_1 + (2x_8 + z_8 + \frac{1}{2}) \mathbf{a}_2 - (2x_8 - z_8) \mathbf{a}_3$	$= a(z_8 + \frac{1}{4}) \hat{\mathbf{x}} - ax_8 \hat{\mathbf{y}} + a(x_8 + \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O II
B₉₁	$= (2x_8 + z_8 + \frac{1}{2}) \mathbf{a}_1 - z_8 \mathbf{a}_2 - z_8 \mathbf{a}_3$	$= -az_8 \hat{\mathbf{x}} + a(x_8 + \frac{1}{4}) \hat{\mathbf{y}} + a(x_8 + \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O II
B₉₂	$= -(2x_8 - z_8) \mathbf{a}_1 - z_8 \mathbf{a}_2 - z_8 \mathbf{a}_3$	$= -az_8 \hat{\mathbf{x}} - ax_8 \hat{\mathbf{y}} - ax_8 \hat{\mathbf{z}}$	(96g)	O II
B₉₃	$= z_9 \mathbf{a}_1 + z_9 \mathbf{a}_2 + (2x_9 - z_9) \mathbf{a}_3$	$= ax_9 \hat{\mathbf{x}} + ax_9 \hat{\mathbf{y}} + az_9 \hat{\mathbf{z}}$	(96g)	O III
B₉₄	$= z_9 \mathbf{a}_1 + z_9 \mathbf{a}_2 - (2x_9 + z_9 - \frac{1}{2}) \mathbf{a}_3$	$= -a(x_9 - \frac{1}{4}) \hat{\mathbf{x}} - a(x_9 - \frac{1}{4}) \hat{\mathbf{y}} + az_9 \hat{\mathbf{z}}$	(96g)	O III
B₉₅	$= (2x_9 - z_9) \mathbf{a}_1 - (2x_9 + z_9 - \frac{1}{2}) \mathbf{a}_2 + z_9 \mathbf{a}_3$	$= -a(x_9 - \frac{1}{4}) \hat{\mathbf{x}} + ax_9 \hat{\mathbf{y}} - a(z_9 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O III
B₉₆	$= -(2x_9 + z_9 - \frac{1}{2}) \mathbf{a}_1 + (2x_9 - z_9) \mathbf{a}_2 + z_9 \mathbf{a}_3$	$= ax_9 \hat{\mathbf{x}} - a(x_9 - \frac{1}{4}) \hat{\mathbf{y}} - a(z_9 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O III
B₉₇	$= (2x_9 - z_9) \mathbf{a}_1 + z_9 \mathbf{a}_2 + z_9 \mathbf{a}_3$	$= az_9 \hat{\mathbf{x}} + ax_9 \hat{\mathbf{y}} + ax_9 \hat{\mathbf{z}}$	(96g)	O III
B₉₈	$= -(2x_9 + z_9 - \frac{1}{2}) \mathbf{a}_1 + z_9 \mathbf{a}_2 + z_9 \mathbf{a}_3$	$= az_9 \hat{\mathbf{x}} - a(x_9 - \frac{1}{4}) \hat{\mathbf{y}} - a(x_9 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O III
B₉₉	$= z_9 \mathbf{a}_1 + (2x_9 - z_9) \mathbf{a}_2 - (2x_9 + z_9 - \frac{1}{2}) \mathbf{a}_3$	$= -a(z_9 - \frac{1}{4}) \hat{\mathbf{x}} - a(x_9 - \frac{1}{4}) \hat{\mathbf{y}} + ax_9 \hat{\mathbf{z}}$	(96g)	O III
B₁₀₀	$= z_9 \mathbf{a}_1 - (2x_9 + z_9 - \frac{1}{2}) \mathbf{a}_2 + (2x_9 - z_9) \mathbf{a}_3$	$= -a(z_9 - \frac{1}{4}) \hat{\mathbf{x}} + ax_9 \hat{\mathbf{y}} - a(x_9 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O III
B₁₀₁	$= z_9 \mathbf{a}_1 + (2x_9 - z_9) \mathbf{a}_2 + z_9 \mathbf{a}_3$	$= ax_9 \hat{\mathbf{x}} + az_9 \hat{\mathbf{y}} + ax_9 \hat{\mathbf{z}}$	(96g)	O III
B₁₀₂	$= z_9 \mathbf{a}_1 - (2x_9 + z_9 - \frac{1}{2}) \mathbf{a}_2 + z_9 \mathbf{a}_3$	$= -a(x_9 - \frac{1}{4}) \hat{\mathbf{x}} + az_9 \hat{\mathbf{y}} - a(x_9 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O III
B₁₀₃	$= -(2x_9 + z_9 - \frac{1}{2}) \mathbf{a}_1 + z_9 \mathbf{a}_2 + (2x_9 - z_9) \mathbf{a}_3$	$= ax_9 \hat{\mathbf{x}} - a(z_9 - \frac{1}{4}) \hat{\mathbf{y}} - a(x_9 - \frac{1}{4}) \hat{\mathbf{z}}$	(96g)	O III
B₁₀₄	$= (2x_9 - z_9) \mathbf{a}_1 + z_9 \mathbf{a}_2 - (2x_9 + z_9 - \frac{1}{2}) \mathbf{a}_3$	$= -a(x_9 - \frac{1}{4}) \hat{\mathbf{x}} - a(z_9 - \frac{1}{4}) \hat{\mathbf{y}} + ax_9 \hat{\mathbf{z}}$	(96g)	O III
B₁₀₅	$= -z_9 \mathbf{a}_1 - z_9 \mathbf{a}_2 + (2x_9 + z_9 + \frac{1}{2}) \mathbf{a}_3$	$= a(x_9 + \frac{1}{4}) \hat{\mathbf{x}} + a(x_9 + \frac{1}{4}) \hat{\mathbf{y}} - az_9 \hat{\mathbf{z}}$	(96g)	O III
B₁₀₆	$= -z_9 \mathbf{a}_1 - z_9 \mathbf{a}_2 - (2x_9 - z_9) \mathbf{a}_3$	$= -ax_9 \hat{\mathbf{x}} - ax_9 \hat{\mathbf{y}} - az_9 \hat{\mathbf{z}}$	(96g)	O III

$$\begin{aligned}
\mathbf{B}_{161} &= -z_{11} \mathbf{a}_1 - (2x_{11} - z_{11}) \mathbf{a}_2 + \frac{(2x_{11} + z_{11} + \frac{1}{2})}{z_{11}} \mathbf{a}_3 & = a \left(z_{11} + \frac{1}{4} \right) \hat{\mathbf{x}} + a \left(x_{11} + \frac{1}{4} \right) \hat{\mathbf{y}} - ax_{11} \hat{\mathbf{z}} & (96g) & \text{W I} \\
\mathbf{B}_{162} &= -z_{11} \mathbf{a}_1 + (2x_{11} + z_{11} + \frac{1}{2}) \mathbf{a}_2 - \frac{(2x_{11} - z_{11})}{z_{11}} \mathbf{a}_3 & = a \left(z_{11} + \frac{1}{4} \right) \hat{\mathbf{x}} - ax_{11} \hat{\mathbf{y}} + a \left(x_{11} + \frac{1}{4} \right) \hat{\mathbf{z}} & (96g) & \text{W I} \\
\mathbf{B}_{163} &= (2x_{11} + z_{11} + \frac{1}{2}) \mathbf{a}_1 - z_{11} \mathbf{a}_2 - \frac{z_{11}}{z_{11}} \mathbf{a}_3 & = -az_{11} \hat{\mathbf{x}} + a \left(x_{11} + \frac{1}{4} \right) \hat{\mathbf{y}} + a \left(x_{11} + \frac{1}{4} \right) \hat{\mathbf{z}} & (96g) & \text{W I} \\
\mathbf{B}_{164} &= -(2x_{11} - z_{11}) \mathbf{a}_1 - z_{11} \mathbf{a}_2 - z_{11} \mathbf{a}_3 & = -az_{11} \hat{\mathbf{x}} - ax_{11} \hat{\mathbf{y}} - ax_{11} \hat{\mathbf{z}} & (96g) & \text{W I}
\end{aligned}$$

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